THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXI. No. 1560.] LONDON, APRIL 4, 1893. [45TH YEAR. PRICE 6d.

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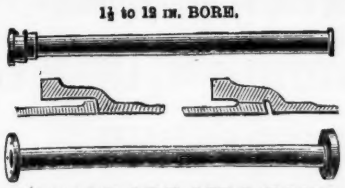

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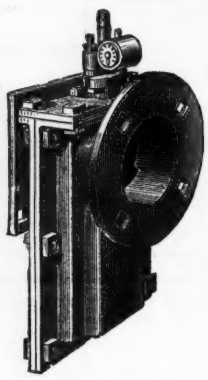

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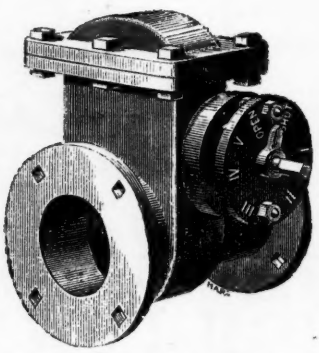

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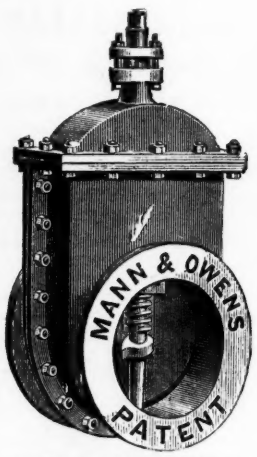

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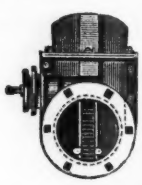

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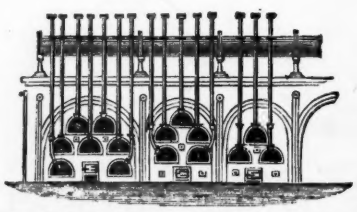

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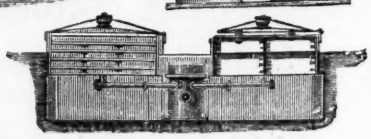

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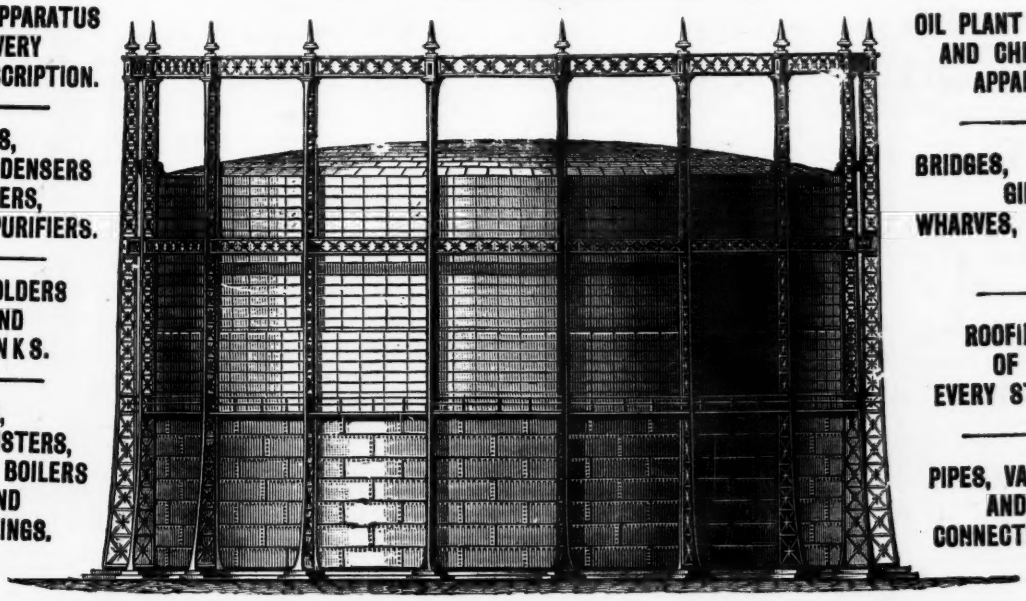

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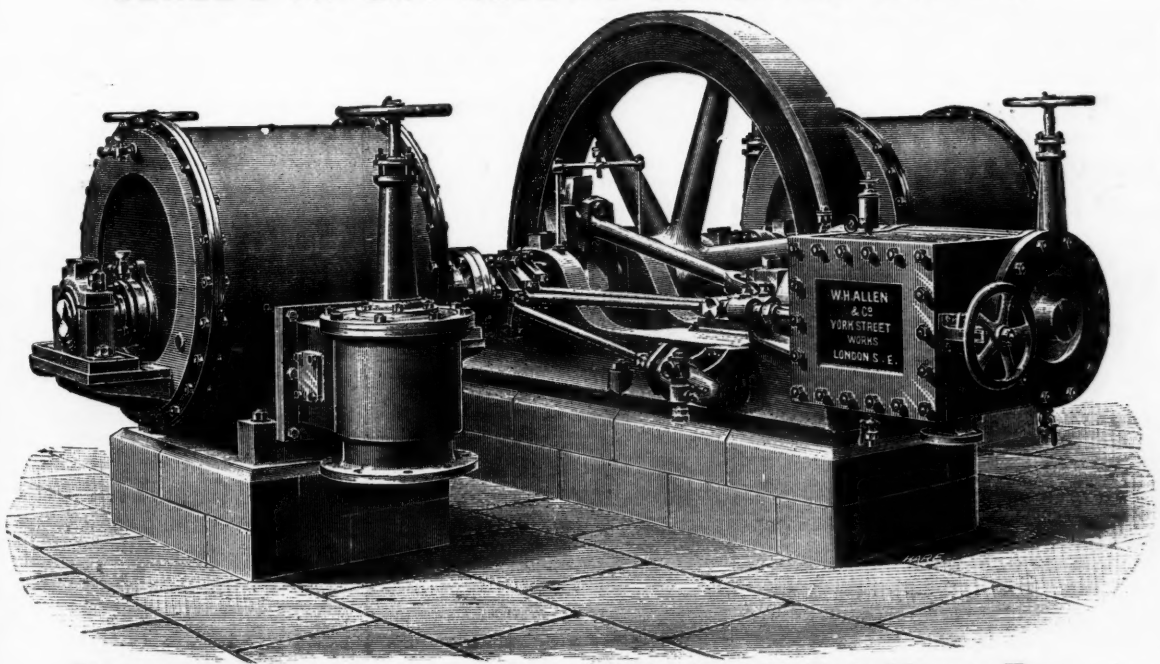

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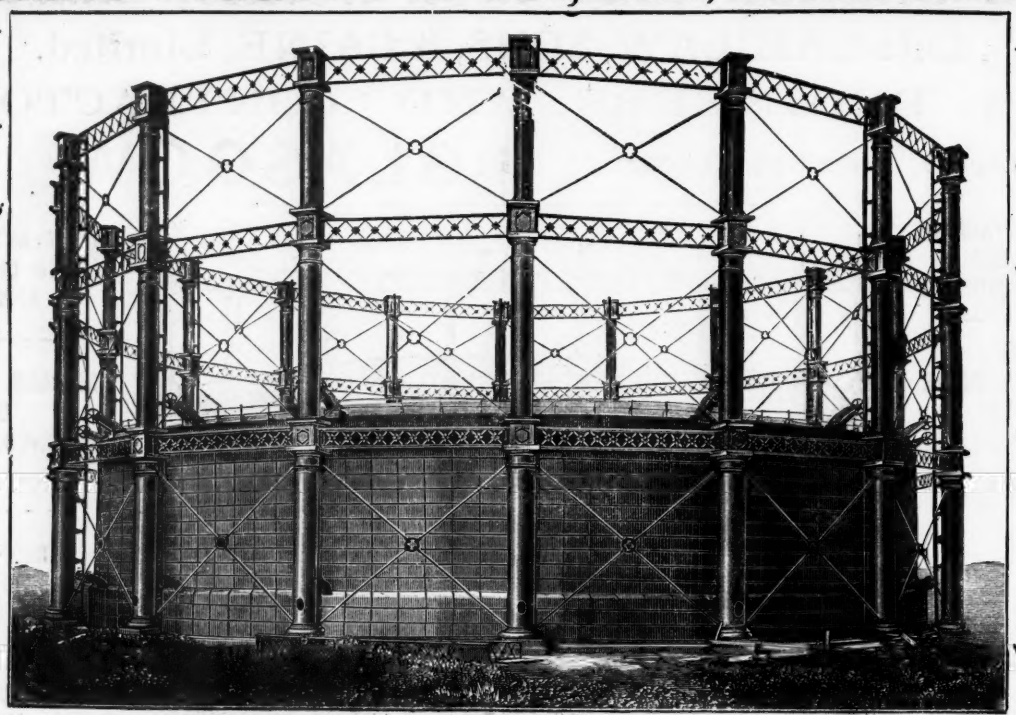

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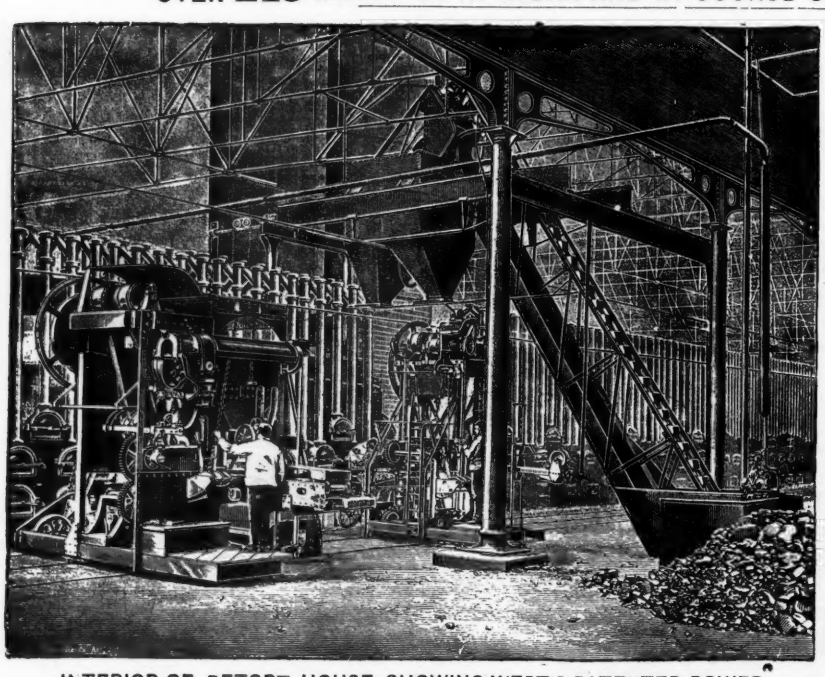

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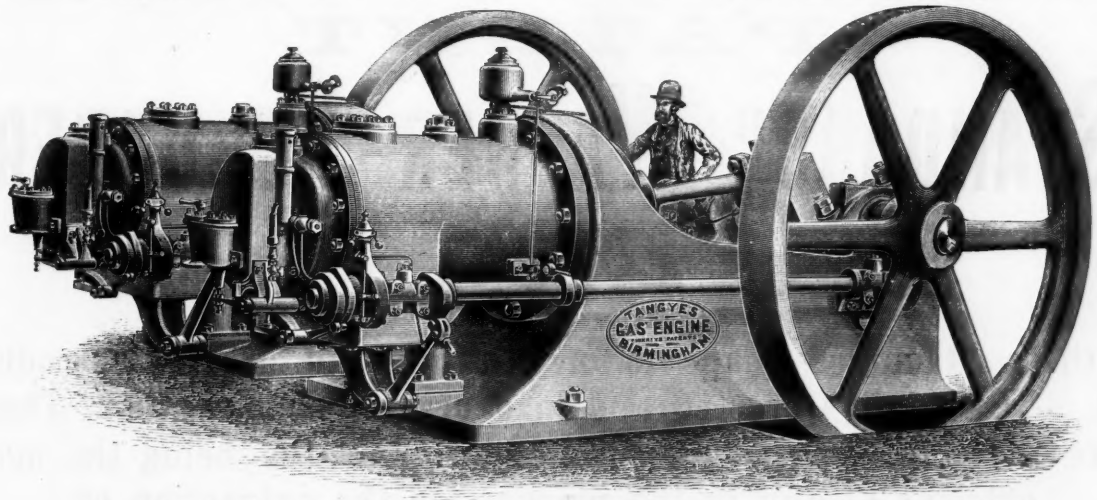

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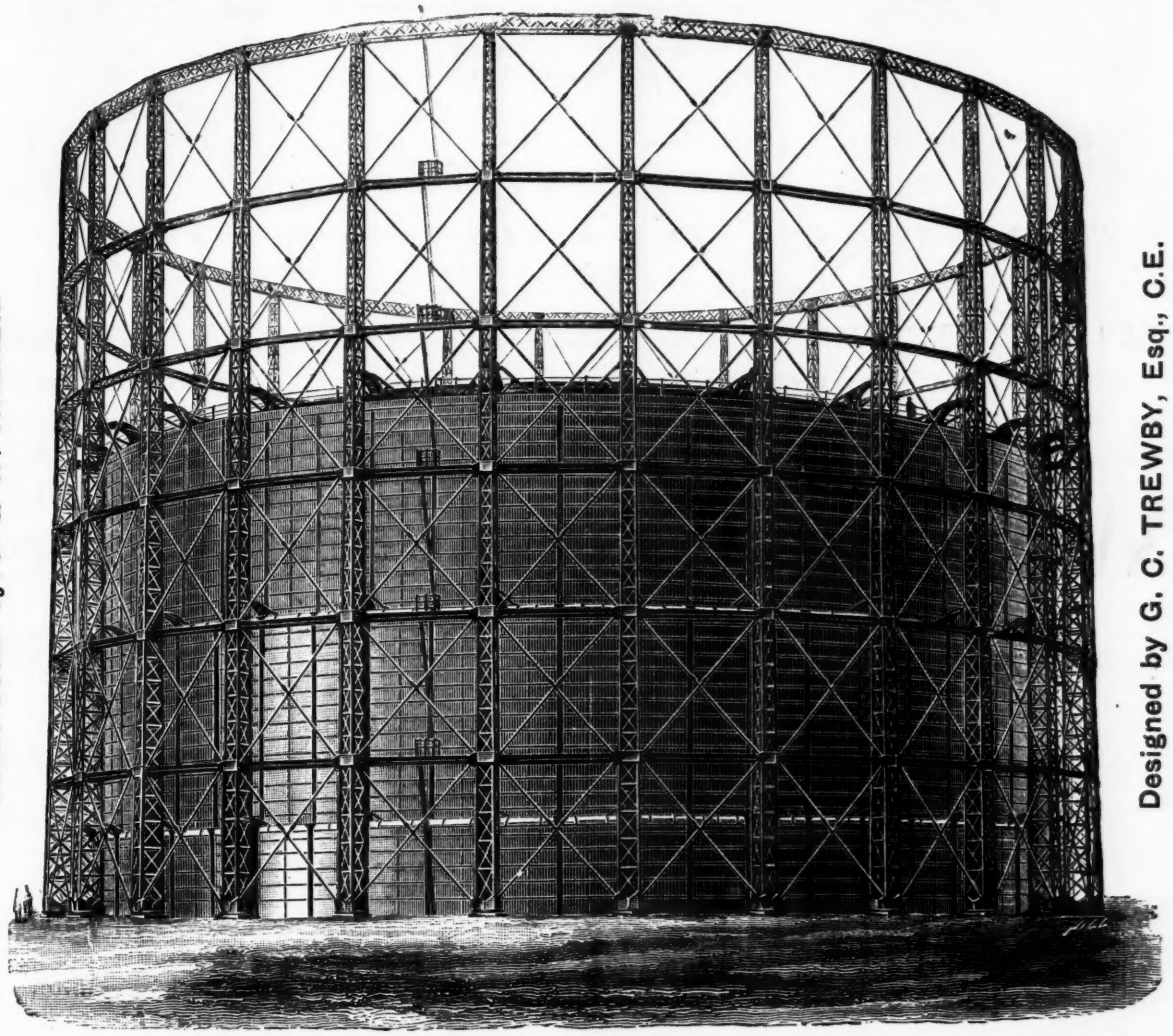

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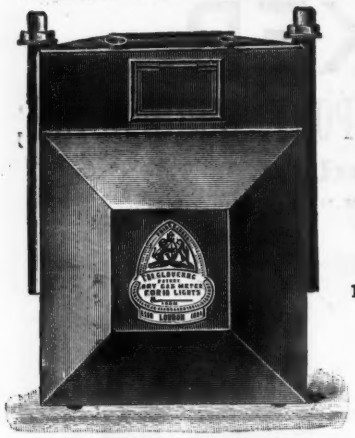

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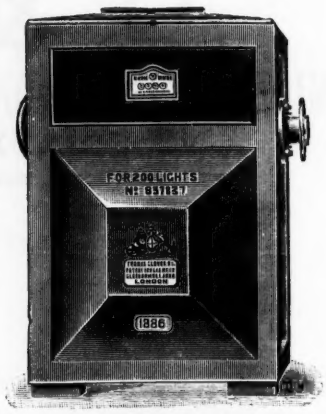

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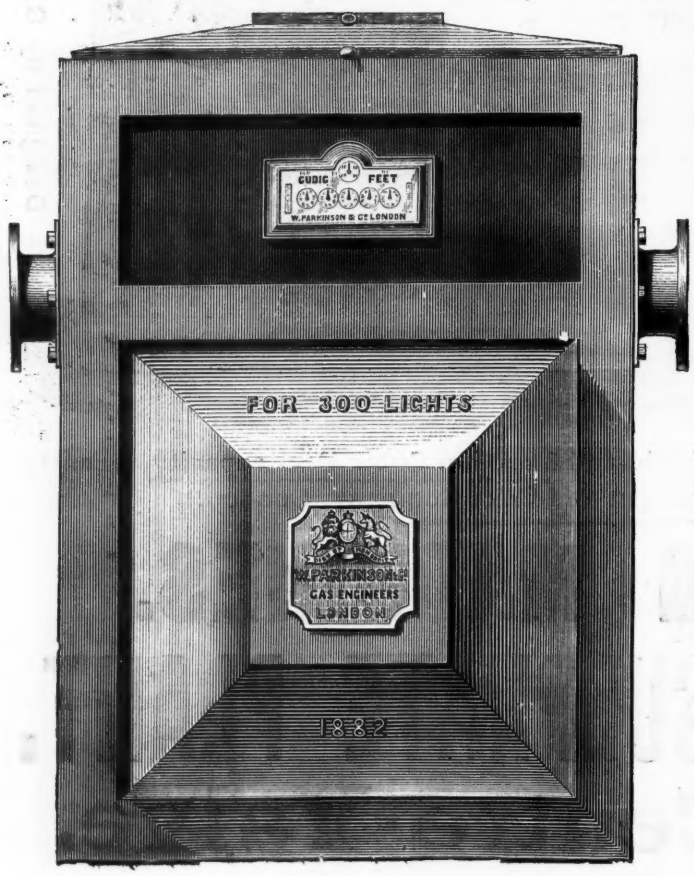

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[See also Advt., p. 616.

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TO CORRESPONDENTS.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, APRIL 4, 1893.

A Return of Strikes and Lock-Outs.

A PORTENTOUS volume has been issued by the Board of Trade, bearing the head-line "Strikes and Lock-Outs" on cover and title-page. It is the report of the Labour Correspondent to the Department on the strikes and lock-outs of 1891, and extends to 546 pages, including tables. Altogether, it is as formidable a Blue-book as we have had the handling of for a considerable period. Whether it is as good as it is voluminous is a query that can only be answered with reference to the point of view of the inquirer. If one looks at it as tending to indicate the spirit in which the Board of Trade is disposed to treat the subject of Labour, it must give keen disappointment to all who have hoped that the Department would act upon broad lines. For it confirms the suspicion we expressed recently in these columns with regard to the way in which appointments to the new office of district correspondent have been made by Mr. Mundella. The Trades Unions have simply captured the Board of Trade; and the present report, which bears the signature of Mr. John Burnett, does not attempt to disguise the fact that he has been content to derive the whole of what he is pleased to call his information about the "labour troubles of the year" and the "leading events in connection with the labour "movement" from returns made by the officials of "only "a small number of Trades Unions representing but "a slight proportion of the total workers of the kingdom." It is to be hoped that some member of the House of Commons will draw attention to the absurdity of spending public money in classifying, tabulating, and publishing statistics of such questionable origin. It may be noticed that Mr. Burnett thinks Trades Unions, being of "national "extent"—that is, nominally—may be trusted as speaking for "practically the whole of those employed in "their "respective trades." But surely this must be admitted to be a debateable point.

Even with this qualification of origin, the report has at the outset some striking statistics to offer in respect of the condition of trade. We saw quite recently how the special representative of the cause of the unemployed in Parliament managed to get up an inflated case by picking out from a similar Blue-book to this a return by one society for a particular month, making out a somewhat high proportion of idle members. Mr. Burnett gives figures showing that, in "certain Trade Societies" the percentage of unemployed members was only 3·39 in 1891, and 5·25 in 1892. Since 1889 trade has been declining, with the result that the "strike policy," where acted on, has had a changed object. Prior to 1890 men struck for higher wages; but since then, if they have struck at all, it has been against reductions of wages.

The report gives a number of extracts from the "opinions "of Trade Union secretaries," which afford varied reading according as they emanate from experienced and capable men or the nobodies who affect to speak for certain New Unions. Some of the apologists for organizations of the latter class seem to be desperately anxious to justify their existence. This is specially noteworthy in the case of the Sailors' and Firemen's Union, which reports that its seamen members "are not one penny out of pocket for the "money they have paid into the Union, but have gained "considerably financially through their membership." If they have not, it hardly needs a witch to say who has made a good thing out of this Union. The Gas Workers say that "during the year several attempts have been "made by the employers to reduce wages;" but, seeing that this omnivorous society embraces brickmakers and any and every kind of labourers who can be induced to pay for its card, this statement is hardly so explicit as could be wished. It cannot apply to general employment in gas-works. Since, however, even the Gas Workers now admit that they have to be "very judicious" in all their "movements in treating with the employer on "matters connected with work and wages," and concede that, "whenever possible, without loss of dignity and self-"respect, all disputes should be settled in the most "quiet and expedient manner," it is not difficult to divine the state of this once most bellicose of Trade Unions.

We shall probably have to return to the discussion of this Blue-book, for it covers too much ground to be run over in one notice; but we desire to draw attention to Mr. Burnett's "general summary" of the numbers and causes of the various strikes and lock-outs included in his return. Although, he says, trade in 1891 had begun to decline, and strikes were going out of fashion, there were recorded during the year 893 strikes, affecting 4507 establishments; and there were 14 lock-outs, affecting 48 establishments. Of the strikes traceable to disputes about wages, 45 per cent. are classed as successful, and 23·4 per cent. as partially so. "The number of persons engaged in the unsuccessful wages "strikes was, however, much larger than in the case of the

"successful or partially successful strikes." Strikes arising out of demands for reduced hours only numbered 23, of which not less than 87 per cent. were successful. Strikes against the employment of non-union labour numbered 47; and the greatest proportion of these—51 per cent.—were entirely unsuccessful. There were but few partial successes; this being a question of principle in which compromise is difficult. The successful strikes under this head form 36·2 per cent. of the whole of the class; but it is among the unsuccessful ones that much the larger proportion of persons involved is to be found. Considering the sources of Mr. Burnett's information, his conclusions upon these heads are most instructive. The pity is that he had no means of correcting his data.

The Law Relating to Consumers' Own Meters.

ANOTHER gentleman has discovered that to take up a position of antagonism to a statutory Gas Company on the strength of a private interpretation of the law of gas supply, as relating to the mutual rights and responsibilities of consumers and undertakers, is a risky venture very liable to turn out badly. His name is Vaughan, and he is a resident of that part of Hull which is supplied by the British Gaslight Company. It appears from the particulars of the case that have come to hand that the Company prefer wet meters, whereas this would-be consumer had a fancy for a dry meter; whereupon he was constrained to provide himself with a specimen of this form of gas-measuring apparatus. Upon receiving the statutory demand from the intending consumer to connect the service to this instrument, the Company met him with another statutory request—that they should be allowed to remove the meter for the purpose of testing it. To this, a refusal was returned, upon the ground that the meter had already been duly tested and stamped by an inspector, in accordance with the provisions of the Sale of Gas Act, 1859. If this excuse had been justified in fact, it is to be presumed that the matter would have ended here. The Company knew, however, that the person described as a meter inspector was not really so within the meaning of the Act; and they consequently adhered to their demand for a legal test of the meter before connecting it with their mains. Thereupon they were sued by the intending consumer for refusing to supply. The case was heard by the Hull Stipendiary Magistrate (Mr. Twiss); and, after full consideration, he has decided it in favour of the Company. It is not a matter likely to arouse much feeling, or to create an agitation of the "Gas Companies and the "Public" order, even in Hull; but the Magistrate's words in giving judgment are not either uninteresting or unimportant. He declared that "a strict compliance "with the Act is a condition precedent to a would-be con-"sumer being entitled to provide his own meter;" and he held that the request of the Company to remove such a meter for the space of a few hours was "not an "unreasonable request." It is as well that the nature of the right given to intending consumers of gas within a Gas Company's district should be occasionally illustrated from the magisterial bench. A compulsory supply of any commodity is unknown to the common law; and the enactment of such a condition of trading in the case of a Gas Company is therefore purely statutory, to be exercised only under the specified conditions. The Courts, high and low, are opposed on principle to the slightest stretching of a statutory privilege of this kind. The obligation of compulsory supply is, in effect, the price paid by a statutory Gas Company for the exclusive possession of the district; and all such Companies are perfectly justified in resisting the smallest infraction of the conditions under which consumers are permitted to avail themselves of their privilege. These conditions are neither onerous nor unreasonable; and while no Gas Company would desire to place a superfluous obstacle in the way of an intending consumer, the latter must understand that, if he elects to appeal to the law to aid him in taking up a questionable position, he must act in strict accordance with what the law directs.

Gaslight in Theatres.

A TECHNICAL periodical which is very useful in its degree is the *British Medical Journal*. It is, of course, seldom seen in the hand of anybody but a doctor; yet it has begun to publish a series of special reports upon the sanitary condition of London theatres, which will be fruitless if such information as they may contain is confined to the "Faculty." We notice that in these reports mention is made of the introduction of electric lighting for theatres, in place of gas—and not with unqualified approval. It is remarked that, previous to the introduction of electric light, theatre architects and managers relied to a considerable extent upon the warming effect of the gas used both before and behind the curtain. This source of heat has now been taken away; and in many theatres no other provision has been made for warming. The consequence is that complaints of chilly draughts have become very general. Stoves have sometimes been placed in the corridors; but the result has not been satisfactory. We agree with our medical contemporary that it is highly desirable that the ventilation and warming of theatres should be considered together, and some method adopted for supplying all parts of the house with pure air, warmed or cooled, as the varying conditions of the climate require. Unfortunately, it is difficult to adapt a theatre that was designed to be lit and ventilated by gas to any other system of lighting, without upsetting all the ventilation arrangements. We should say that a compromise might usually be employed with effect. Low galleries and the fronts of the boxes, and places where there is little head-room might be conveniently lit by means of incandescent lamps; but the great sun-light or pendant, which is such a traditional feature of the dome of the auditorium, and serves so well to create an upward current of foul air just where it can be most conveniently collected from all parts of the house and expelled, might well be retained. Indeed, if a powerful central light is required, it is sheer pedantry to supply it by any other means than gas, where the latter can be had. If gas were dearer than electric light, it would be better to use it in this part of all theatres, where at least it is well out of the way.

In Praise of Sulphate.

PROFESSOR JAMES LONG, who is well known as a writer upon agricultural matters, has recently contributed to the *Dundee Courier* an article upon "Sulphate of Ammonia," which, as it appears under the forbidding caution, "All "rights reserved," we are unable to reproduce. However, we gladly welcome anybody and everybody who puts a hand to the good work of recommending sulphate; and therefore we hope that a very much wider circle of readers than the subscribers to, and the casual purchasers of, the newspaper in which this article appears will be somehow made acquainted with the fact that Professor Long has a very high opinion of this medium of enriching land, and does not think it is quite so much appreciated as it ought to be. Nitrate of soda still attracts the farmer's fancy, on account of its apparent cheapness as compared with sulphate; but Professor Long shows that if the former is £1 per ton cheaper, it is a more costly source of nitrogen than sulphate. This is not exactly news; but people are apt to forget facts of the kind unless they are often repeated. Fertilizing by means of nitrate, moreover, is like administering a dram to the vegetation, and like drams of the "light wine of the country" addressed by Professor Long, it is apt to be entirely spoilt by too much water. Sulphate is more stable in its effects, and not nearly so liable as nitrate to be washed out of the ground by excessive rain. This is a consideration of moment where the climate is at all damp. Professor Long quotes from Professor Church a simple test for the purity of sulphate, which consists in placing a pinch of it upon a red-hot shovel, when it should instantly disappear. An even better guarantee of the purity of sulphate would be to purchase it direct from the gas-works where it is made, whenever possible, and save money at the same time. Professor Long comments upon the fact that sulphate is a product of British industry; and he is not ashamed to say that there should be more satisfaction in using it on this account, other things being equal, than in purchasing an imported raw material like nitrate. His short article is well calculated to catch the farmer's eye, and persuade him that sulphate is a valuable fertilizer, though to chemists and others who have studied the subject, he does not appear to bring forward anything novel.

Reasonable Railway Rates.

As a writer in *The Times* reminds us, with this present season of Easter the short period of grace allowed by parliamentary tacticians to the Railway Companies

for revising their rates, has run out. The President of the Board of Trade has pledged himself to take steps when Parliament reassembles after the Easter recess to "bring to their senses" any Companies who are "so ill-advised as to cling to the belief that "Parliament seriously meant what it said when, after "exhaustive discussion, it solemnly enacted that the "rates and charges mentioned 'in the various Provisional "Order Confirmation Acts shall, from and after those "Acts come into operation, be the rates and charges "which the railway company shall be entitled to charge "and make.'" But, the same writer goes on to argue, Jedburgh justice is seldom successful; and he hopes that Parliament, which has hitherto made such a mess of the matter of railway rates regulation, will listen to the teachings of experience before venturing upon any stringent measures for the purpose of coercing the Companies. The article is a plausible plea for further deliberation before placing the Companies under repression; and the best argument in it is that the bulk of the traders' grievances are against the laws of Nature, and are not remediable by the Companies. This is all very well; but it is not to be denied that the *gravamen* of the indictment against the Railway Companies at present lying at the bar of public opinion is that, whereas they asked for maximum rates, and declared their intention of not making any change in their actual charges, they no sooner had what they wanted than they broke their engagements, and put up the rates in all directions. Surely, there is some foundation for the complaints that arose all round from producers and consumers when the new classification came into force, and carriage of so many commodities rose so considerably that a revival of coasting traffic has actually taken place. When a man has to pay a shilling for the conveyance of a customary parcel of goods that used to be delivered for sixpence, it is idle to attempt to persuade him that the carrying company has not "stolen a march" upon him. And if the Railway Companies were not in the wrong, why have so many of them retraced their steps? We take note of this question of maximum as distinguished from actual rates of charge, because this is the statutory condition under which a vast proportion of the gas supply of the kingdom is sold. It would never do for the action of the Railway Companies to be brought forward as an argument against the retention of a maximum price of gas in any Gas Act. We do not care to say much upon this vexed topic, however, because, as we confessed on a prior occasion, the principles of railway management are past the understanding of outsiders; and we are not anxious to be caught laying upon the wrong shoulders the whole of the blame for an apparent injustice.

The Gas Referees' Summer Instructions.—The Notification of the Metropolitan Gas Referees for the ensuing summer contains the usual reduction of the maximum quantity of sulphur allowed in gas to 17 grains per 100 cubic feet.

Paris Water Supply.—The inauguration of the additional supply of water for Paris, from the sources of the River Avre, whereby about 26,500,000 gallons of pure spring water will be delivered in the city daily, took place last Thursday at St. Cloud, where the new reservoirs are situated. The ceremony was performed by the Prefect of the Seine, who gave an interesting historical account of the Paris water supply. He stated that Louis XIII. laid the first stone of the Arcueil aqueduct in 1613; but these springs, which were utilized by the Emperor Julian for supplying his Palais des Thermes (now the Hôtel Cluny), proved a disappointment—that aqueduct bringing only 220,000 gallons per day at ordinary times, and less during drought. Half a century afterwards, pumping appliances were established near the cathedral of Notre Dame, for supplying Seine water to the city. In 1822, a canal from the River Ourcq to La Villette brought 22,000,000 gallons of what was then considered excellent water. Next came the Belleville and the Pré St. Gervais aqueducts and the Grenelle artesian well. In 1865, an aqueduct 80 miles long conveyed 4,500,000 gallons from the Dhuis. In 1875, an aqueduct 206 miles long brought 22,000,000 gallons from the Vannes, near Troyes. The Avre springs will now furnish 57,200,000 gallons. The total supply at present being 156,200,000 gallons, Seine water can be dispensed with. Paris, according to M. Sauton, President of the Municipal Council, has now 290 litres (a litre being rather more than $1\frac{3}{4}$ pints) of water per head of the population—London having only 155; Edinburgh, 180; Leipsic, 150; Vienna and Brussels, 100; and Berlin, 75. He hopes that by the time for holding the 1900 exhibition the springs of the Loing and Lunain will have been brought into use, and so render the city second to none in healthiness.

WATER AND SANITARY AFFAIRS.

THE speech of the Chairman (Mr. George Banbury) at the half-yearly meeting of the East London Water Company last week, embraced a variety of important topics, among which the recent rejection of the Company's Bill by the House of Commons naturally found a place. The further light thrown upon the circumstances to which the Bill related renders it still more regrettable, in the interests of the public, that the measure should have been so hastily set aside. There was no valid reason why the Bill should have been opposed; still less was there any justification for refusing to inquire into its merits. If any Company could be spoken of as having a special claim upon the consideration of Parliament, it would be the East London, with a district of considerably more than one million inhabitants, largely composed of the working classes; the houses in many cases being of so poor a character that the water supply is furnished by the Company at a loss instead of a profit. We may add that the fact of the constant supply being extended to 98 per cent. of the houses throughout the district furnishes a very powerful plea in support of any proposal which the Company may put forward for an extension of their works. Mr. Banbury explained, what the House of Commons might have inferred, that the half-million to be raised in debentures would not all have been called up and laid out at once. The money would have been spent as required, so as to meet the increasing wants of a growing population. Another feature in the case, as stated by the Chairman, is that the money would have enabled the Company to carry out a scheme which the Royal Commissioners had desired to have submitted to them, for creating storeage reservoirs in the valley of the Lea. In accordance with the request thus made, Mr. W. B. Bryan, the Company's Engineer, had laid the necessary plans before the Commission, and had given evidence thereon. The first step in the extension of the works would have been to increase the present storeage to 1200 million gallons; thereby precluding all danger in the event of drought. So strongly had the Company felt the wisdom of such a provision, that they had already secured the necessary land. It could never have been supposed that Parliament would have refused assent to so beneficent and reasonable an undertaking—one which was much desired by General de Courcy Scott, of the Local Government Board. But now the entire project is arrested; and should a drought occur, with disastrous consequences, at no distant period, the responsibility will rest with Parliament—the London County Council having played the part of an accomplice before the fact. It must have been well understood by those who led the attack, that their only chance of success lay in keeping the Bill from going to a Select Committee. Once there, its merits would have been discerned; and such a measure must have received approval. When the Bill was before the House, enough was urged in its support to warrant the second reading. But much more remained to be said, which now unfortunately comes too late, except to expose the extraordinary error committed by the House of Commons—an error which leaves an extensive population exposed to a calamity from which the foresight of Parliament ought to have protected it.

Another subject of peculiar interest, and one which bears largely on the main question of the Metropolitan Water Supply, was adverted to in the early part of Mr. Banbury's address. The East London Company have been sinking a deep well at Lea Bridge. For a long time the work proved very troublesome; but now the water rushes in at such a rate that, as the Chairman says, they have been "drowned out." Although water has been pumped from this well at the rate of more than three million gallons per day, it has not been found possible to reduce the level sufficiently for the workmen to get again into the headings. The well at Waltham Abbey gives upwards of two million gallons per day. These results show the reasonableness of the expectation that an abundant supply of water is obtainable from the chalk. Referring to the geological evidence given before the Royal Commission, Mr. Banbury said there was no doubt that a very large volume of water from the chalk in the Lea basin was continually passing away seaward, and that only a small portion was intercepted by the Company's wells. There was nothing to prove that Hertfordshire was being depleted by the Company's pumping operations. The

point is one of extreme importance; and the facts which are coming to light are all of an encouraging nature, as to the extent of the resources both in the valley of the Lea and the Thames. Filtration, as it is at present practised by the London Water Companies taking a supply from the rivers, is achieving a degree of success which, as Mr. Banbury observes, seems to astonish everybody; and finally there is the emphatic testimony of Dr. Frankland, showing that the supply at command in the London basin will be sufficient for another century. Of course, the supply will be insufficient if no more money is to be spent upon it, and if Parliament means to perpetuate the policy by which the East London Bill has just been denied consideration. Yet any inquiry that will involve the Companies in trouble and expense seems popular in Parliament; and, relying on this tendency, the County Council are asking for power to spend any amount of money they please on any subject which, in their opinion, affects the public interest. Of course, the water supply is aimed at; and it seems as if the "inquiry" system would never end.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 603.)

Business in the Stock Exchange just previous to Easter time has, according to invariable custom, been at a low ebb; and, if anything were needed to emphasize the tendency to holiday making, it was the exceptionally fine weather, which tempted many to make play while the sun shone. Had it not been for the fact that it was account week—a matter which could not be disregarded—business would, in all probability, have been at its nearest to zero point. In spite of the quietude, however, the general tendency was in favour of prices on the whole, though, in one or two of the markets, exceptional agencies directed special courses. Money was in fair demand for the settlement (which was satisfactorily adjusted); and the market remained pretty firm until the close. The Gas Market attracted about as much business as might have been expected at the season. Movements have been rather irregular; some quotations having advanced, while others have receded. Among the latter is Gaslight "A," which had begun to evince a tendency to easier prices towards the close of the preceding week. A fall of 2 was made in the quotation; but the marked prices at which business was done thoughout the week were steady, and showed no disposition to droop. The secured issues (debenture, preference, and limited) were all very active and firm; and the 6 per cent. debenture stock has advanced 2 more. South Metropolitans were quiet and steady; and the same may be said of Commercials. The latter Company will hold their general meeting on Thursday of next week; the Easter holidays interfering with their usual fixture of the first week in April. Among the Suburban and Provincial undertakings, Brentford has improved 1 in its old stock; but Alliance and Dublin old has receded ½—the accounts for the last half of 1892 showing that the earnings are £3500 short of the amount required to pay the dividend. None of the other Companies present any very remarkable feature; and the only change is in Ottoman, which is quoted ¼ better *ex div.* The Water Companies have again been pretty active and very firm; and several quotations have gone up to a moderate extent.

The daily operations were: The Gas Market opened on Monday unchanged; and the old prices held good throughout the day—business being very moderate. In Water, Chelsea rose 1½; and both Lambeth issues, 2 each. Tuesday's business and prices were much the same as those of the preceding day; but Gaslight "A" was lowered 2, while the 6 per cent. debenture stock rose to a like extent. Wednesday was quieter still; but the tone was good. Brentford old went up 1. In Water, East London advanced 1; and Lambeth debenture, ½, on *ex div.* adjustment. Thursday was busier, especially Gaslight secured issues. Ottoman gained ¼; but Alliance and Dublin old fell ½.

ELECTRIC LIGHTING MEMORANDA.

The Electric Lighting of Bristol—Electric Lighting of Public Buildings—Wanted, to "Learn the Electric Light."

The Bristol Corporation have commenced the carrying out of their electric lighting scheme according to the plans of Mr. W. H. Preece. The total capital outlay is expected to amount to £82,300, as to which it is a significant circumstance that the first item, for piling, turns out to be double what was estimated. This is, of course, a purely local consideration; but, in laying down central electric lighting plant, something of the same kind is apt to occur everywhere—if not for one thing, for another. As may be supposed, the Bristol newspapers are able to inform their readers that Mr. W. H. Preece "takes a very favourable view of the prospects of the scheme." His calculations of revenue are based upon the usual jugglery with incandescent lamps and gas-burners. He puts the 35-watt incandescent lamp as "comparing favourably" with a gas-burner consuming 5 cubic feet of gas per hour, and "giving a light of about 10 candles." The electric lighting plant is to be capable of supplying 14,000 lamps at one time, which means that 28,000 such lamps "may" be connected to the mains, because only one-half of the lamps on circuit will ever be in use together. Then supposing the double load of lamps to earn 9s. each all round, by consuming 18 units per annum, at 6d. per unit, they would return the respectable revenue of £12,600. It is curious that the Notting Hill Company, who have laid out £77,850 upon their undertaking, or nearly as much as the Bristol figure, have only been able to sell £2578 worth of electricity for the past year; but it would never do to check electricians' estimates by reference to actualities.

A writer in the *Electrical Review* raises once more the familiar complaint that the electric light fittings of many public buildings continue to the present the appearance, most offensive to electricians, of being "merely of a temporary nature." It is remarked that this feature of the electrical fittings of museums, public libraries, large blocks of business offices, &c., is sufficiently obvious to appeal to the observation of any ordinary frequenter of such places, and that it is "likely enough to give rise to the reflection that a serious want of confidence is still shown towards this method of illumination on the part of those who nevertheless have adopted it." Among the conspicuous characteristics of this style of electrical fitting which help to give it this aspect of some temporary or tentative arrangement, this critic cites a "want of general arrangement and adequate effect, which results principally from an incorrect, because exaggerated, estimate, which assigns too large an area per light for its illuminating power." He notices also the "unseemly compromise" that still widely exists between the adoption of the electric light pure and simple and the retention of the previous gas-fittings. It is incontestable that in many places too much is expected of the electric lamps; but this is directly due to the misleading assertions of electricians themselves in regard to the suitability of 8-candle lamps for taking the place of gas-burners. According to the reports already noticed, this is the same delusion which Mr. Preece is waving before the eyes of the Bristol people, who will be disillusioned in due course. As to the retention of gas-fittings side by side with the electric lamps, the writer of the article now under notice gives the right explanation of the practice when he assigns it to want of confidence. We are not inclined to make too much of the occasional extinctions of electric lamps in public and private use which come to our knowledge; but they are far more common than would generally be supposed from the universal silence on the subject. Of course, these little accidents can always be explained by reference to collapsed fuses, short circuits, and so forth. But then, as somebody has pertinently remarked, it is always easy to explain failures; it is only success that is never explained.

The humours of advertisement columns of newspapers devoted to "situations vacant and wanted" have often been noted by facetious writers; but in a recent issue of the *Electrician* we observed an advertisement of the kind in which the humour almost runs over into pathos. It is the appeal of a young man who wishes to "learn the electric light," and professes his willingness to pay a small premium for the opportunity of doing so. The advertiser has probably been pounced upon ere now by some of the particularly wide-awake and early birds who eke out a precarious (electrical) existence by picking up such worms; and consequently nothing we can say on the trite subject of the hollowness of electrical engineering as a profession is likely to avail him. The terms of the artless appeal, futile as it must prove, awaken a responsive chord in a sympathetic breast. Who does not want to "learn the electric light?" This bright and elusive creature of modern physical and engineering science has engaged the study of thousands of the keenest intellects on earth since two or three clever people managed about fourteen or fifteen years ago to put it into a working dress, and make it quit the laboratory for the street and the house. But can anybody truthfully claim to have "learnt it" yet? Alas! no. There is the difficulty. A vast amount of information has been acquired of and about it. We are familiar with its appurtenances and fitments; and we know that, if we want it, the luxury is not to be attained save at a heavy cost, and even then there may be great discouragements in the pursuit. But the light itself is still the almost chance product of a most extravagant, roundabout, and delicate series of operations, connections, and adjustments; and they who know most about it must be content to go on "learning it" without present hope of arriving at a complete understanding of the nature of the thing of which the light is only one manifestation.

A Simplification of Fractional Distillation.—When it is not desired to collect separately the fractions of an oil passing over at different temperatures, but merely to ascertain their volume and weight, A. Tigerstedt proposes, according to the *Berichte der Deutschen Chemische Gesellschaft*, to receive the distillate in a graduated vessel placed on the pan of a small balance, by which approximate weighings can be made during distillation.

ON THE POINT OF VIEW.

When Gulliver, in Swift's famous satire, arrives at the kingdom of Brobdingnag, he finds himself regarded as a very different personage from what he had been amongst the Liliputians. To the puny inhabitants of Liliput, he had seemed a colossus in human form—a veritable monster of the giant race; to the Brobdingnagians, he appears the tiniest specimen of humanity ever imagined in thought or dreamed of in dreams. Yet he is conscious of remaining the same Lemuel Gulliver, an average Caucasian, of medium stature, who, at home in England, passed unnoticed among the gay throng in the park or on the crowded street. So true is it that the impressions we receive, and the opinions we form, are determined by our point of view.

How otherwise can we explain the seeming anomaly of statesmen professing the same aims of peace, prosperity, and progress, yet divided into two hostile camps; and measures, proposed for the attainment of those ends, supported by the one and opposed by the other? And not alone in politics does this peculiarity appear. Our Law Courts are devoted to the comparison and adjustment of opposing or divergent views of the same subject or occurrence. What are the labour disputes, which are so marked a feature of our time, but the clashing together of opinions necessarily diverse, through the same subject being regarded from different points of view? And so throughout the ramifications of society the same law operates. For so long as men look at the problems of life and conduct from different points of view, so long will there be divergence of opinion among them. Nor is it an unmixed evil that we are so constituted. It is this very diversity that, in society, gives zest to intercourse, and, in politics, produces progress and thus prevents stagnation and death. Yet, while the pleasure and interest of life would be seriously curtailed were there not, in mankind, the variety springing from this cause, we might spare ourselves much heartburning and contention did we but recognize that our opponents may be just as sound in their convictions and sincere in their aims as ourselves, although taking different points of view.

We have been led to these reflections through perusing the judgment of Lord Justice Smith in the recent prosecution of the South Metropolitan Gas Company for nuisance by sulphuretted hydrogen, said to have been given off from the sulphate plant at their Old Kent Road works. A great deal had been made during the trial of the emission of steam arising from the spent liquor of the sulphate stills, which was said to carry the offending noxious gas over the property of the complainant, to its detriment. Now, there was, in connection with the sulphate plant, where the nuisance was said to emanate, a small lime-pump of ½-horse power. The exhaust steam from this pump was given off, according to the evidence of Mr. F. Livesey, through a 1-inch pipe, and was in itself so insignificant a matter that it does not seem to have been noticed by the prosecution, nor was it mentioned in the case by either side. Indeed, the lime-pump was, from an ordinary point of view, so far removed from the subject of the action that, had the matter been raised before the trial, it might have been said to have as little to do with the nuisance complained of as, to a superficial observer, Tenterden Steeple has with Goodwin Sands. To Mr. Livesey and his subordinates "a pump it was, and nothing more;" exciting in their minds no more interest, and causing no more concern, than perhaps scores of other pumps upon the works. Yet this "harmless, necessary" pump proved a turning-point in the whole case. The Judge went to view the place. His mind full of the arguments advanced in the case, and perhaps especially impressed with the importance that had been attached to the agency of steam in accentuating the nuisance complained of, his eye caught the steam-pipe just referred to. It did not concern him to know that the pump to which it was attached was a very small apparatus, of no more significance than any other pump on the premises. From his point of view, it was the steam which was the crucial matter; and whereas so much stress had been laid on the important part, in promoting the nuisance, played by steam merely evolved from the surface of the hot liquor, here was an escape of steam under pressure, of which nothing had been said. From this moment there appears to have entered the judicial mind a suspicion that the evidence submitted by the defence had not been so explicit as it might have been; that, in his own words, to have been kept in ignorance of this matter for days shook his confidence in what had been asserted for the defence. Doubtless this remark surprised no one in Court more than those responsible for the defence. To them the incident of the lime-pump would probably appear as the introduction into the case, at the last moment, of an element entirely foreign to it, as undoubtedly it was *from their point of view*. Yet, *from the Judge's* it was one of the most weighty factors going to make up the preponderance of evidence on the side of the prosecution.

Here, then, we have an illustration—very pointed, because of such far-reaching consequences—of the vast importance which may attach to the point of view, even in regard to small affairs; and it is because the incident illustrates very forcibly what is in multitudinous matters a daily occurrence that we have been led to devote attention to it to-day.

MUNICIPALISM "IN EXCELSIS."*

The method of comparison of actualities is firmly established as one of the most reliable guides to the attainment of truth by critical investigation. Instead of starting with a preconceived ideal of what is the truth of any particular matter, and co-ordinating evidence in support of this opinion (which nine times in ten would have no existence outside the mind of some one man), it seems now to be generally understood that truth—practical, workable truth, that can be handled and made to bear fruit for the use of mankind—can be attained more certainly by picking out verities from many existing sources, and exhibiting them as parts of the thing desired, which have been actually possessed by people. This is the method by which common-sense men, who are interested in the matter of municipal government, are now seeking information. We have had the prophetic era, presided over by Dr. B. W. Richardson, to whom and to his less-gifted followers we owe many wonderful pictures of cities of Hygeia, and of minor human settlements fit for, and seemingly occupied by, an angelic race of beings disguised as men and women, who never do anything ill. It would be wrong and ungrateful to say that the world has benefited in nothing by these Richardsonian rhapsodies on the theme of Sanitation; but it is quite certain that practical men who have to do with the building and administration of cities intended for the habitation of ordinary human beings are accustomed to think of them (when they remember them at all) as "counsels of perfection." It is the same with the proposals of writers of text-books upon water supply, gas engineering, harbour and dock construction, and many other subjects. They are so greatly given to imagining a town of a given size, and possessed of some very convenient qualifications of a general nature, and absolutely devoid of the awkward little peculiarities that every existing town of the same size exhibits; and then they say, for the instruction of the student of the art or science they profess: "Let us arrange a water supply, or build a gas-works, or make a harbour for this imaginary town." Unfortunately, in real life things do not suit themselves to the designer so perfectly as they do in the text-books. And as to Dr. Richardson, and the rest of the school of sanitary prophets, it seems cruel to describe them as being "out of date," seeing that the arch-prophet himself is still living and as active as ever. But it must have long since been borne in upon the consciousness of those who formerly read of the City of Hygeia with delight, that theirs is not the way of redemption for the dwellers in the actual cities of earth. Howsoever we might wish it, we cannot start fresh and build model cities upon virgin sites, and supply them with immaculate water and everything necessary to put their amiable inhabitants in the way of that cleanliness which is not merely next to godliness, but, in the estimation of some fanatical sanitarians, is even more necessary for mankind. Our business is with the London and Liverpool, the Edinburgh and Manchester and Glasgow—aye, and the "Little Peddlington," of this present day. We have to take these places as we find them, and we shall have done our duty if we leave them in any appreciable degree more wholesome and desirable places of residence and centres of industry than we found them.

Mr. Pollard is interested in the sanitary and general well-being of Edinburgh; and some time since he appears to have bethought him that he might look about for hints of how municipal affairs are managed in other notable cities. He could not go to Hygeia, for a very sufficient reason; but finding himself in Berlin, he appears to have considered that he might as well look about him, and draw what instruction he could gain from the remarkable example of municipalism that lay under his eyes. It must in fairness be stated, however, that Mr. Pollard did not "discover" Berlin, in the sense of a city administered with success upon enlightened principles. Many travellers before him—including the shrewd writer who calls himself "Mark Twain"—had already "spotted" Berlin, if the term may be permitted, as a place where something might be learnt in the way of town management. Nor is this to be wondered at, seeing that the gigantic intellect of Virchow has been engaged for twenty years and upwards in the honourable service of the citizens, upon the problem of making the capital of United Germany better worth living in. And here is a most remarkable thing to begin with. We in England are so mortally afraid of everything in the way of dictation in municipal matters, or of what is called "grandmotherly government," that we prefer to leave the initiative in everything to the ratepayers—that is, to the mass of the least instructed inhabitants of our towns. In the United States, it is even worse; for there, although it is in theory the mass of the people who govern, in fact the reins of power are abandoned to the lowest of the populace, and their professional organizers, who are ignorant of everything except the art of political corruption. How can good fruit come of such a tree? As a matter of fact, the fruit is bad, hopelessly bad, although the cost of producing it is enormous. In the United Kingdom, municipal matters are better than they are in the States; for while we may have the

* "A Study in Municipal Government. The Corporation of Berlin." By James Pollard, C.A., Chairman of the Edinburgh Public Health Committee, and Secretary of the Edinburgh Chamber of Commerce. Edinburgh: William Blackwood and Sons; 1893.

inefficiency and blundering, we have not the corruption. In Germany, however, the first noticeable aspect of the municipal system is that men like Virchow are connected with it. This is because, in regard to the appointments to the higher municipal offices, the corporations are subject to be overruled by the State. Of course, no such system is possible for us; but let us not forget, while we applaud the freedom with which our own mayors and the chairmen of county councils are chosen, to acknowledge the cost of the system. We have as good men in the United Kingdom as can be found outside it—good engineers, chemists, and so forth. But they are not, as a rule, to be found confined to the service of a particular Municipality. Indeed, the admirer of the democratic idea, as we have marked it in the London County Council, seems to entail the filling of the most responsible municipal offices with mediocrities, or worse.

In following Mr. Pollard through his most interesting and instructive account of the municipal life of Berlin, therefore, we must recognize at the outset that we are asked to look at the working of a benevolent despotism, which is something very different from the principle of government under which we live. But granted this despotism, intelligently administered, how well and cheaply the work is done! Berlin is at present without doubt the best-governed city in Europe; and this is done at the lowest cost to the Government. There must be something in Empire which influences trade; but what it is cannot be learnt from the economists. How else is it that, during the last few years, Berlin—a town of no special natural advantages that anybody can discover—has grown at a rate unparalleled in Europe? The city has a population of 1,635,000, which could be doubled by extending the nominal limits of the town. In a few years, it will be second only to London among the capitals of the world. Mr. Pollard tells how this vast population is cared for by the Town Council and the Magistracy, numbering some 158 individuals, who among them do everything—manage the streets, buildings, lighting, cleaning, water supply, drainage, gas supply, hospital, parks, common schools, markets, poor relief, police, and finance. The rates are graduated according to the amount of the rental; and Mr. Pollard seems to think the ratepayers are burdened about the same as those of Edinburgh for ordinary municipal purposes.

The water-works, under the management of an Englishman (Mr. Henry Gill), have attracted considerable attention, owing to the adoption of a general meter system to prevent waste, and enable the works to keep up with the natural requirements of the growing city. Formerly a domestic water-rate of 4 per cent. was levied; and there was great waste. Unless something had been done, the Company formerly owning the works would have been ruined; for they could not afford to erect the extra works necessary to give an increased supply. Eventually an additional source of income was found in economy. "What was required by the necessities of the case was not more water, but a proper and reasonable use of that which was available. The history of the Company, as Mr. Gill himself puts it, was, like the history of water companies in general, the record of an incessant struggle to diminish or prevent waste." The introduction of the meter system was tentative; select blocks of buildings being experimented upon. The consumers saved money upon their old rating without stinting themselves in water for all necessary purposes, only they looked after the waste themselves. The Siemens water-meter is in use; and the system has been made general since 1878. The whole city does with 15 gallons per head per day, of which 3 per cent. is used for public sanitary purposes; and the poor Berliners strike Mr. Pollard as being cleaner in their persons and their houses than the Edinburgh people.

Mr. Pollard has something to say about the Berlin gas supply, of which he does not write in the language of an expert, but still with respectable knowledge. It is stated that no English coal has been used in the Municipal works since 1865; all the gas being made from Silesian and Westphalian coal. "By the introduction of the new method of treating coal gas with oxygen, the quality of the gas has been much improved; and it yields a light 22 candles strong." The price to private consumers is 4s. 8d. per 1000 cubic feet, of which the 8d. represents the cost of the public lighting, which is laid upon the shoulders of the private consumers—a highly unjust arrangement, we should say, more especially as the municipal treasury nets a profit of £250,000 a year out of the gas undertaking. What Mr. Pollard rightly describes as a "novel practice" of the Corporation Gas Department is the insuring of consumers against loss by explosions; and, out of the profits of this insurance business, provision is made for the widows of any gas-works employees who die in the service. Even despotic Berlin agrees with democratically-ruled corporations owning gas-works in other countries in "robbing Peter to pay Paul."

As may be supposed, we cannot follow Mr. Pollard through all the contents of his book, which deals with a great deal of matter that would be foreign to our columns. We have no hesitation in asserting, however, that everybody interested in municipal work should obtain and diligently read this by no means heavy volume; for while it may not be possible to admire everything done by the Berlin Town Council, it is certain that there is much to be learnt from their way of dealing with problems of town administration that are common to all Municipalities.

NOTES.

"Cyclone" Collectors.

Professor C. V. Boys, F.R.S., has contributed to *Industries* an interesting description of the principle and action of the "cyclone" dust collector—an apparatus designed in the first place for the purpose of removing dust from air, whether with the object of recovering the dust for its own sake or to remedy a nuisance. In its perfected form, the appliance is capable of purifying gases from suspended liquid or solid particles. Professor Boys speaks of the invention as affording a beautiful illustration of the success of the simplest possible contrivance in accomplishing a much-needed result where more elaborate devices have failed. The difficulty has been, not to make a machine on the centrifugal principle—in which the whirling dusty air should have the dust carried to the outside in virtue of its greater density, and so separating it out—but to arrange that as it is separated in this way the air and dust should be continuously delivered. The "cyclone" apparatus consists essentially of a vessel of the form of a simple cone, or of a cone surmounted by a short cylinder of the same diameter as the wide end of the cone, having a small hole at the pointed end, and a large central hole in the cover at the wide end. The dusty air is driven in tangentially at the wide end; and what happens inside is as follows: The air describes a spiral path along the inner surface of the cone towards the narrow end; the depth of this spiral layer being apparently very small. As the air approaches the narrow end, it gradually moves inwards—continuing its rotation in the same direction, but reversing its axial motion; and so it describes within the outer spiral course a new spiral journey in the opposite sense, and thus escapes round the outer portions only of the large opening. There is an in-draught of air at the small opening, and also in the centre of the large one. The dust separates from the air; and simply falls out of the bottom opening—it is not blown out. The same process is observed when the apparatus is used for cleaning steam, &c. The action is not due to gravity, but is dynamical. It seems to be a pertinent question whether a modification of this apparatus could not be used for freeing crude coal gas of mechanically carried impurities.

The Composition of the Atmosphere.

A question as to the preservation of the balance of oxygen in the atmosphere has been raised in the *Chemical News* by Dr. T. L. Phipson. It is argued, to begin with, that the chemical constitution of the atmosphere must have changed in successive ages, just as the various flora and fauna of the earth have done. The presence of combustible substances such as pyrites, molybdenite, copper pyrites, and graphite in the primitive rocks is interpreted by Dr. Phipson as indicating that if these rocks had been formed by fusion and crystallization by slow cooling, free oxygen must have been entirely absent from the air at the time, or they would have been burnt up. Again, that carbonic acid must have been present in the atmosphere in much larger quantities than at present during the period of the life of the coal flora, has appeared to many to be proved by the enormous residues of carbon that have come down from those times, as compared with the more recent deposits of lignite and peat. Water and air are considered by most modern writers on cosmogony as the residual products left over after the cooling of the earth from the stupendous chemical actions which went to the formation of the earth's crust. It is due to these residual products that the globe happens to be fit for the existence of the organized beings that now inhabit it. But was the air in primitive geological periods the same mixture we now know? Dumas and Liebig appear to have regarded the chemical composition of the atmosphere as having been fixed from an indefinite period, and supposed it to be maintained by the balanced action of plants and animals; the former giving out oxygen and absorbing carbonic acid, while the latter do the opposite. Charles Martins, a celebrated French naturalist and contemporary of Dumas, criticized this compensation theory by pointing out the extremely minute quantity of air affected by the respiration of plants and animals as compared with the vast bulk of oxygen in the atmosphere. Thus he shows that the atmosphere contains 134,000 cubic measures of oxygen, while the entire animal world does not consume more than 15 to 16 of these measures in a century (this is Dumas' own computation); hence the constant composition of the atmosphere must depend, not upon a fancied equilibrium between the respiration of plants and animals, but upon the fact that the quantity of oxygen consumed by animals is out of all proportion to that contained in the entire atmosphere.

Is the Composition of the Atmosphere Likely to Alter?

Berzelius, cited by Dr. Phipson, declared his conviction that the contents of oxygen in the air must gradually diminish, because he could not formulate any de-oxidizing process sufficiently great and general to set at liberty so much oxygen as combines every instant with combustible material. The Dutch chemist Mulder goes still further. Having regard to the enormous and increasing production of carbonic acid, and the diminution of forests, he concludes that carbonic acid must increase, and that oxygen has progressively diminished in quantity since the first appearance of life upon the earth. Lastly, Koene, of the University of Brussels, upholds the contrary and, in the circumstances, the more comfortable theory that the carbonic

acid and the nitrogen of the air have never ceased diminishing since the origin of living creatures, while the relative proportion of oxygen has gone on increasing. This theory is based upon the presumption that in remote geological ages there could have been no free oxygen in the air at the high temperatures to which all combustible bodies were exposed. As soon as circumstances permitted the existence of living things, a sort of vegetation appeared which did not need oxygen, and prepared the earth, during a vast lapse of time, for the higher organisms which were to follow. This vegetation began the production of oxygen, which attained its maximum activity during the coal-flora period. According to this view, therefore, the luxuriant flora to which we owe our coal not only prepared our fuel, but, in its lifetime, was largely instrumental in stocking the atmosphere with oxygen. What is to happen when all the coal is made to return its carbonic acid by the process of combustion, does not clearly appear.

Californian Petroleum.

The immense store of mineral oil contained beneath the surface of the soil in California has for some years past been worked to a considerable extent—as much as 25,000,000 gallons having been raised in 1888. But nevertheless no thorough investigation of the chemical and physical properties of the oil has hitherto been made. Messrs. F. Lengfeld and E. O'Neill have now undertaken the research; and the results of a preliminary examination of the oil have been given in the *American Chemical Journal* for this year—a wish to retain the subject for further investigation being expressed by the writers. The samples examined were from the Pico Canon, Los Angeles County, and were thick oils of a dark green colour, of ·8414 sp. gr. at 15° C., and of 1·4810 refractive index at 14° C. On distillation, very little came over below 40° C.; but above that temperature it distilled with great regularity—the distillates collected for each 10° rise in temperature being almost equal in amount. The specific gravity and refractive index of each fraction are given in the paper. The lower fractions were water white; but the higher ones were slightly coloured, and exhibited a marked fluorescence. The portion of the oil which passed over below 110° C. was treated with a mixture of nitric and sulphuric acids, and a heavy liquid, resembling nitro-benzene in odour, was obtained; but attempts to purify it were frustrated by its sudden decomposition on distillation. Such a decomposition frequently ensues when an attempt is made to distil nitro-benzene manufactured from impure benzol. The preliminary examination revealed the presence of hydrocarbons of the paraffin series, of naphthenes, and of benzene homologues in the petroleum. Consequently, it appears to be intermediate in composition between the Russian and Pennsylvanian oils.

A Large Block of Cannel for Chicago.—On Monday last week an enormous "cob" of cannel coal, from the Abram Collieries, Wigan, arrived by train at the Alexandra Dock, Liverpool, for shipment to Boston in the steamer *Philadelphian*. It is said to be the largest block of coal ever dug from the earth—weighing upwards of 12 tons; and it took nine months to hew it out of the seam. It is said that the cost of obtaining it was £1000—about £83 per ton. When raised, the cob was enclosed in a case of planks; the weight of the whole being 13 tons 11 cwt. It arrived safely at the Alexandra Dock, and its shipment was witnessed by a large crowd of people. The time occupied in shipment was only 30 minutes. From Boston the coal will be conveyed by train to Chicago for the World's Fair.

Increased Risk of Natural Gas as Fuel.—According to the *Engineering Record*, the effect of the introduction of natural gas as a fuel in large cities is having a very severe influence on insurance risks and rates. The demolition of a considerable portion of a large building in Chicago, by an explosion of natural gas in the cellar, has awakened the insurance people of that city to the possible conditions induced by the presence of the gas. When the piping was first laid in Chicago, last November, a committee of insurance men was appointed to investigate the subject; and they advocated in their report special permissions for the introduction of natural gas into buildings, as is usual for extraordinary risks. Nothing, however, has been done in regard to the matter; but recent explosions, with consequent fires, in Chicago and elsewhere, have raised the question in a new shape that will probably lead to more definite action.

The Late Mr. C. Crew.—In the JOURNAL last week we announced the death, on his return voyage to England, of Mr. Charles Crew, the Chairman of the Antwerp Water-Works Company. The deceased gentleman was specially identified with water undertakings, and personally supervised, as Resident Managing Director, the construction of those of the above-named Company, and in addition to the Directorship held by him in the Companies named last week, he was Secretary of the Seville Water Company. Mr. Crew had been out of health for some time; and, under medical advice, he had taken a trip to the Cape. On the outward journey, two months ago he derived great benefit. But on his way back to England in the *Mexican*, two days before reaching Madeira he was stricken with appolexy while at dinner. Deceased was a Freemason, and was Master of the Shirley Lodge. He was also a Royal Arch and Mark Mason, and was P.M.W.S. of the Canute Rose Croix Chapter of Southampton. He was about 52 years of age.

COMMUNICATED ARTICLES.

OXIDE OF IRON: A MONOGRAPH.

By John T. Sheard, F.C.S.

INTRODUCTION.

Oxide of iron has been, in the past, such a boon to the gas manager, enabling him to rid the gas of its most noxious impurity without causing nuisance to his neighbour, and is still so extensively employed in purification, that it may well afford one of the most interesting and profitable subjects of study in the technics of gas making. It is therefore somewhat strange to find that it has not received the share of attention in technical literature which would appear commensurate with its importance. It is true the matter has been investigated to some considerable extent. Researches have, at various times, been made, and papers written, on the subject; but it has been done, as it were, piecemeal. Much yet remains to be accomplished before the action of the material is fully understood, and its capabilities thoroughly under control; while of so much knowledge as has been established on the subject, there exists no complete and adequate account.

The following is an attempt to collect together, into one homogeneous whole, the scattered fragments of reliable information on the subject of oxide of iron, and its treatment and behaviour in gas purification, which have been published through the technical press; some endeavour having also been made, by original investigation, to elucidate doubtful points, and to fill up, to some extent, the gaps that still appear in our knowledge of the matter. The article does not profess to be final and conclusive in its statements. The subject is so recondite, and its investigation is beset with so many difficulties, that while, in some directions, desirable knowledge is to be gained through mere intelligent observation in the gas-works, in others the information required is only to be gained through a long course of careful experiment skilfully devised to effect this end. Ample leisure, together with exceptional facilities for research, must be devoted to it before the problems the subject still presents are cleared up. It is only when we come to face such problems, and discover how profound is our ignorance of the *rationale* of some of the commonest operations of gas making, that we realize the need there is, and the scope that exists in gas-works, for the research chemist, whose primary occupation shall be the probing and solution of these problems. But it is hoped the article may, at least, be found to repay perusal for bringing together in connected form a clear account of what is most securely established on the subject of which it treats, and, by showing the deficiencies that still exist, lead to fuller investigation by others.

HISTORICAL SUMMARY.

From the very first, when the necessity arose for purifying the evil-smelling product of the first attempts at gas making, it seems to have been perceived that oxide of iron would be a suitable agent to employ. Thus Heard, Winsor's assistant, patented, in 1806, a process of purifying gas by passing it over heated lime; and he claimed, as an alternative to lime, "iron or other metals or their oxides." Later inventors claimed the same materials applied in various ways. Thus Palmer, in 1818, proposed to pass the gas through a red-hot purifier filled with fragments of iron or oxide of iron "at a minimum of oxidation." But either they never actually put the matter to the test, or, as is more probable, their ideas were too crude and faulty to succeed. Down to the time of the publication of Clegg's "Treatise on Gas Manufacture," in 1841, the material had evidently never been successfully applied to gas purification, or it would doubtless have been referred to in that excellent work. Croll had taken out a patent, in 1840, for "the application of the black oxide of manganese for removing sulphuretted hydrogen," in which he mentions incidentally that the same effect as with the manganese may be produced by "the oxide of zinc and *the oxides of iron*" when "treated precisely in the same way." But the meagre notice and the subordinate position given to oxide of iron in the specification lead to the inference that Croll had not actually demonstrated the value of this material for the purpose, but had simply, from theoretical considerations, included it with the other substances, to which it bore, of course, chemically considered, some resemblance. The same remarks will apply to the inclusion of oxide of iron in Laming's patent of Nov. 4, 1847, wherein he claims its use in a mixture with other materials—apparently a very subordinate position in the mixture being assigned to the oxide. There is as yet no mention of the valuable property the material possessed of revivifying itself, after being fouled, by simple exposure to the air. The first evidence we have of this property being known, and the first clear indication of oxide of iron having been successfully applied in the purification of gas, appears in a French patent taken out by Laming, on Feb. 22, 1849. Unfortunately for himself, he omitted to seek British protection for his invention, with the result that the reward which was justly his due was taken by others.

To Mr. F. J. Evans belongs the credit of having first, in this country, brought into use the process of purification by means of oxide of iron. Laming having requested the Directors of the Chartered Gas Company to try his material, this was done by

Mr. Evans, their Engineer, in August, 1849; and from the time of this experiment dates the gradually increasing adoption of the use of oxide of iron for the elimination of sulphuretted hydrogen from coal gas. Strangely enough, though Laming had patented the revivification of the material by exposure to air, he does not seem to have informed the Chartered people of this valuable property; and it was left for Evans to make the discovery for himself. With characteristic ingenuity, Evans perceived that he could improve upon Laming's method of revivifying the oxide; and, instead of taking the material out of the purifiers and exposing it to the air, he drew air through the material *in* the purifier, after the latter was thrown out of action. Thus at that early date (October, 1849) was introduced the process of revivification *in situ*.

As yet, however, the material employed was not oxide of iron pure and simple, but a mixture of that substance with calcium chloride (muriate of lime); the latter being intended to take up the ammonia and carbonic acid. This, of course, at its first exposure, it did; but the lime once saturated with carbonic acid was no more effective—becoming merely so much inert material, diluting the more continuously effective oxide of iron. It was left to Hills to show that the oxide could be more effectively employed by itself, without the inclusion with it in the purifier of any other active ingredient; provision being, however, made for the presentation of the oxide to the gas in a finely-divided, yet sufficiently permeable state. Accordingly, he obtained a patent, dated Nov. 28, 1849, in which he claimed purifying coal gas from sulphuretted hydrogen "by passing it through the precipitated or hydrated oxides of iron," either by themselves, "or, which is much better, made into a porous material by being absorbed into or mixed with sawdust, or breeze, or peat charcoal in coarse powder, or other porous or absorbent material, so as to be readily permeable by the gas." He further claimed "repeatedly renovating or reoxidizing the said purifying materials by the action of the air whenever they, from time to time, cease to absorb sulphuretted hydrogen, so that they may be used over and over again to purify the gas."

Hills's patent became eventually, as the value of the process of purification therein described was more and more demonstrated, the subject of extensive litigation. But whether, as was asserted by his opponents, he acquired his knowledge from the witnessing of Evans's experiments, or from Laming's French specification, or whether, as he affirmed, it was the fruit of his own investigations, there can be no doubt that his specification was the first publication in English showing a clear appreciation of the right use of oxide of iron in gas purification, and of the conditions favourable to its success. And this was evidently the view of the Courts, as its validity was throughout upheld.

It was the precipitated or hydrated oxide which Hills had, in his patent, specifically claimed; and in 1852 we find Lowe and Evans claiming the anhydrous form. But it appears to have been decided by the Courts that there was not sufficient novelty in this invention to constitute a distinct advance upon Hills's claim; and accordingly the latter held the field. No better fortune attended the patent of Chisholm, in 1854, which claimed the application, for the purpose of purifying gas, of "the peculiar red earthy or ochry-looking substance found mingled with peat and the subsoil of peat." This is the first mention of the use of native or bog iron ore in gas purification.

Oxides and Hydrates.

Here it may be well to explain briefly, in ordinary language, so much of the chemistry of oxides and hydrates as is needful to enable the remarks on the subject in hand to be clearly comprehended by the general reader. An oxide, as its name implies, is a chemical combination of an element with oxygen. The same element may combine with different amounts of oxygen—thus forming two or more distinct oxides; for example, there are three oxides of iron. Further, oxides combine with water to form hydrated oxides, or hydrates; and like as one element may have several oxides, so the same oxide may unite with different amounts of water to form several distinct hydrates. This union must, however, be something more than a mere combination; it is needful that the water and oxide be held together by some degree of chemical affinity. Thus we might mechanically mix any quantity ot water with red hematite, which is anhydrous (unhydrated) oxide of iron, without converting it into brown hematite—the hydrated form. It would remain a mere mixture, out of which the associated water could be separated by drying at ordinary temperatures. To produce artificially the hydrated oxide of iron, we must precipitate, by means of an alkali, the metal from a solution of one of its salts; the oxide, together with its water of hydration, being thrown out of solution at one operation. On the other hand, lime, which is oxide of calcium, needs only to be brought into contact with water to become hydrated; and the water cannot be again separated therefrom without recourse to a red heat.

Chemists are not agreed as to the exact nature of the union between an oxide and water; and therefore such combinations are, in chemical language, indifferently termed hydrates and hydroxides. The former term implies that the water and oxide exist independently, but are in chemical union with each other; the latter, that the elements of water have entered into other combinations in the new compound. The phenomena presented by different members of this class are sufficiently varied to lend countenance to both views. Thus, apart from the difference, already alluded to, in the mode in which hydration is brought about, there is considerable variation among hydrates in the closeness or strength of the union between oxide and water. For example, calcium hydrate, as before observed, needs to be brought to a red heat before parting with its water of hydration; while the corresponding hydrate of barium is not decomposed by heat alone, but must be exposed, while at a red heat, to a stream of air or oxygen. On the other hand, precipitated ferric hydrate (hydrated oxide of iron) gradually and continuously loses its combined water on heating, from ordinary atmospheric temperatures, until completely dehydrated at 900° Fahr.

Sesquioxide of Iron, or Ferric Oxide.

The particular oxide of iron used in the purification of gas is what is termed the sesquioxide, or, more commonly, ferric oxide, and consists of two equivalents of iron combined with three of oxygen; or, in other words, the iron is united with one and a half times its combining volume of oxygen. Its chemical formula is therefore Fe_2O_3. Its hydrate contains one or more equivalents of water, dependent upon the circumstances under which it has been formed, and the nature or extent of the dehydration process to which it may have been subsequently exposed. Freshly precipitated ferric hydrate is generally said to contain three equivalents of water (Fe_2O_3, $3H_2O$); but, according to the researches of Carnelley and Walker,* no definite stable ferric hydrate is formed—the compound losing water in greater or less degree according to the temperature to which it is exposed. These authors, for example, found that precipitated ferric hydrate, after being dried in air at 60° Fahr. for eighteen days, contained more water than is required for the formula Fe_2O_3, $5H_2O$; and, on heating, the water was gradually and continuously given off until the anhydrous oxide (Fe_2O_3) was left at about 900° Fahr. Ferric hydrate, it is also said, can be totally dehydrated by prolonged ebullition in water.

Ferric oxide occurs in Nature both in the anhydrous state and hydrated—forming those hematite ores which are the mainstay of the iron industry, as well as the more earthy bog ores which are suitable for gas purification. It is also produced artificially on a large scale, as a bye-product in certain manufacturing operations. Both the native and the artificial oxide are largely used in the purification of gas. The former is chiefly a hydrated form of the oxide, which occurs, interspersed with earthy matter and decaying vegetable and other organic remains, in the subsoil of peat bogs.† The latter is either hydrated or anhydrous, as may have been determined by the manner of its production; but, for reasons which will be explained further on, the artificial oxide employed in gas purification is generally either wholly or in part hydrated.

(*To be continued.*)

COAL GAS: ITS MANUFACTURE, DISTRIBUTION, AND CONSUMPTION.

A Series of Articles for Gas Students.

Exhausters.

(*Continued from p.* 545.)

Exhausters are principally of two types—the rotary and the reciprocating. Jones's, Root's, and Beale's types are rotary; Methven's, Dempster's, and Anderson's are reciprocating. Of the rotary type, the last mentioned (Beale's) is the one generally employed in this country; and as the various forms of this exhauster differ somewhat according to the ideas of the respective manufacturers, it will be best to follow the precedent set earlier in these articles, and describe a make of machine which may be taken as typical in principle of the whole class.

Messrs. Gwynne and Beale's exhauster may, in point of excellence, both as regards the details of its constructive design and workmanship, be considered not only as a typical, but also as an ideal exhauster. In construction it is as follows: There is an outer cylindrical case, which is provided with inlet and outlet pipes, and inside of which revolves a drum or roller whose diameter is two-thirds that of the outer case. The axes of both cylinders are horizontal—not coincident, but parallel. The axis of the roller is at such a level below that of the outer case, that the roller in its revolutions is actually in contact with the bottom of the cylinder, although not resting upon it. The drum or roller revolves upon a spindle or shaft, which, passing through stuffing-boxes suitably affixed on the end plates of the outer case, is fully supported on two large gun-metal bearings placed at either end outside the machine. The internal workings are thus relieved of all stress or strain. The drum is provided with a radial double diaphragm, the length of which from side to side is equal to that of the cylinder; and in its revolutions, and by means described further on, it is caused to continuously sweep the inner walls of the cylinder, and thus force the gas from the inlet on the one side to the outlet on the other. Cast in the inner face of each end of the roller is a radial groove or channel, which passes through the axis of the roller, and is equal in length to the diameter of the latter. In the periphery of the

* *Chem. Soc. Journal*, Vol. LIII., p. 59.

† For a detailed and interesting account of the formation and mode of occurrence of bog ore deposits, the reader is referred to a paper by Mr. C. Eastwood, read before the Manchester District Institution of Gas Engineers, in 1882. (See JOURNAL, Vol. XXXIX., p. 469.)

roller are two slots corresponding with these grooves. Through the slots, and guided by the grooves, freely slide two diaphragms or blades, which, being planed and faced, slide over one another and in the grooves, and together form one double diaphragm, which varies in width according to the relative positions of the two single diaphragms to each other. The sectional construction of the roller provides for internal radial bearing surfaces, one on each side of the slots referred to; so that the slides have a bearing in the drum and on each other of a width equal to nearly the whole diameter of the drum.

It has just been stated that the object of these slides is to continuously sweep the inner walls of the outer case; also that their revolution is accomplished by the drum, whose axis is not coincident with, but *below* that of the cylinder. In other words, these diaphragms turn about a centre which is eccentrical to that of the cylinder. As, however, the line or course described in the revolutions by the outer edges of the diaphragms—*i.e.*, the internal face of the outer cylinder—is circular, it follows that their diameter or radii must vary. This is provided for in the sliding arrangement already referred to, by which the width of the double diaphragm is caused to vary in accordance with the position in relation to the outer cylinder.

This can best be illustrated as follows: Cut out two circular discs of cardboard, B and A, 1 and 1½ inches in diameter respectively. Draw centre-lines a^1 through each; and draw another centre-line b^1 across B at right angles to a^1. Place B upon A so that the centre-lines a^1 are in the same vertical line, but that the lower edge of B rests upon that of A. Now take two ordinary pins, 1¼ inches long; call them *c* and *d*, and place them along the centre-line b^1 so that the head of *d* shall rest on the circumference of A on the right hand, and that of *c* on the left—their point ends lying side by side, and over the centre of B. Now, A will represent the outer case of the exhauster; B, the roller or drum; *c d*, the double diaphragm; b^1, the line across the drum occupied by the diaphragm. If lines be drawn along b^1 from the circumference of B to within (say) 3-16ths inch of the centre, and just bearing on *c* and *d* above and below, they will represent the internal bearing surfaces of the drum already referred to; and *c d* in this position is about 7-16ths of an inch long. If now B be turned 1-8th round to the left, and *c d* with it, the heads of the pins will no longer rest on the circumference of A—*c* projecting beyond, and *d* being short of the position required. Readjust them along b^1 so that, as before, their heads may rest on the circumference of A. Turn B round 1-8th more, and again, until a revolution is completed; each time readjusting the pins as described. *This adjustment of the pins, if continuous, represents precisely the automatic sliding movements which take place during the revolutions of the roller*, and by which the diaphragm expands in width or contracts as required by its varying positions in relation to the outer cylinder.

The automatic movement is effected thus: On the inner face of the end plates of the outer cylinder is cast a circular recess or channel, the outside edge of which is coincident with the inside walls of the cylinder. In this recess travel freely two segment plates (one for each diaphragm), which fit it perfectly, are light in construction, and have a large bearing surface. The diaphragms are bored right through their length parallel with the axis of the roller, and near to their outer edge. In the holes thus bored fit steel pins of great strength, which have a considerable bearing surface, and rotate freely in the holes. One end of each pin is fitted square, and driven tightly into one of the segments just mentioned; while the other end is turned, and fitted truly into a corresponding segment at the opposite end of the machine, and about which the segment may freely turn while travelling around in its circular recess. The blades, rotated by the drum, are thus drawn in and out by the segments, which, travelling in a circular course concentric with the outer cylinder, therefore maintain the steel pins, and consequently the adjacent outer edges of the diaphragm, in positions which are always the same in relation to the inner walls of the cylinder. The blades are kept in contact with the inner walls of the cylinder by means of a T-shaped slip, having a flat spring at the back; the web of the T and the spring being let into a suitable groove in the edge of the blade. Power is communicated to the drum-spindle, either from a steam-engine direct, and perhaps fixed on the same bed-plate with the exhauster, or by belt pulleys or other means. Full provision is made for thoroughly lubricating all the bearing parts of the machine, and friction is reduced to a minimum.

The importance of good workmanship and efficiency in an exhauster will be seen from the following quotation from Mr. Newbigging's "Handbook":—

> The essential features of a good exhauster are that it should work with a minimum of friction and power, that it should give the steadiest possible flow of gas, and that the parts should be perfectly gas-tight. Beale's exhauster, when well constructed, satisfies these conditions. The commonest fault is the want of tightness; and when it is remembered that, under a pressure equal to a 14-inch column of water, about 9000 cubic feet of gas will pass per hour through an opening of only one square inch in area, the absolute necessity of the best workmanship only being used in exhausters will be evident.

In some cases the exhausters are subjected to much greater pressure than this; a Gwynne and Beale exhauster at Manchester having to work against 28 inches, while the speed is only 70 revolutions per hour.*

* See JOURNAL Vol. XLIV., p. 948.

The makers of this exhauster have patented an arrangement in the interior, whereby a perfectly steady vacuum or pressure is maintained. A similar, though not so pronounced, effect is produced in their arrangement of twin exhausters, where the blades of each machine are so arranged as to work at right angles to one another. In Donkin's exhauster, a single blade is used, and it revolves on a steel pin concentric with, instead of eccentric to, the main cylinder; a similar provision being made in Waller's exhauster, where two, three, or four blades are provided, according to the requirements of the make.

Of reciprocating exhausters, Dempster's and Anderson's are alike in principle, and comprise a steam-engine and gas-pump combined; the latter being similar in form to a steam cylinder, and provided with piston and piston-rods, slide-valves, &c. There are other forms of pumps, which are fitted with clack-valves; but these are not in general use. Dempster's pattern consists of two large double-acting pumps, with a small steam-engine between them; the whole being secured to one bed-plate, and one crank-shaft connected to all three pistons. The pumps are arranged to work at quarter centre, so that the delivery of gas may be even and regular. Provision is made for working either one or both pumps at once, and also for lengthening or shortening the stroke in the pump cylinders. The range of working capacity of this exhauster is therefore very large, which facilitates its ready adaptation to the varying requirements of the works. Mr. Anderson has given considerable attention to the design of exhausters especially suited to the requirements of very small works. His arrangements are remarkably self-contained, convenient, neat, and inexpensive. Some of the patterns comprise boiler, engine, exhauster, governor, and bye-pass in one compact machine. These are designed more particularly for small works, where the putting down of an ordinary exhausting plant would be too expensive a matter; and they doubtless must soon repay their first cost.

Excessive and insufficient exhaustion have both to be guarded against—the former because by it air may be drawn through the retorts and mixed with the gas, the illuminating power of which will thus be seriously depreciated;* the latter, for reasons already indicated in this chapter. The irregularity with which the gas comes from the retort-house, together with the necessary variations of pressure from the steam-boilers, renders the constant maintenance of an even exhaust—without some special regulating device—an utter impossibility. (In this connection, the remarks made early in this series of articles,† and relative to so arranging the retort-house work as to have the gas coming off in fairly even quantities hour by hour, are particularly applicable.) It is necessary, therefore, to make some provision for regulating the work done by the exhauster in accordance with the quantity of gas flowing forward. The plan most usually adopted is as follows: A bye-pass main connects the inlet and outlet pipes of the exhauster, and is provided with a throttle-valve, to the spindle of which is fixed a weighted quadrant. This is connected by rods and chains to the lever-arm of a gas-governor, which is actuated by a supply-pipe from the exhauster inlet. The holder is counterbalanced and weighted so as to maintain a given amount of exhaust. If this be exceeded, the governor falls, and allows the quadrant to open the throttle-valve; thus admitting, by the bye-pass main, a portion of the *exhausted* gas through the exhauster again, and preventing any undue exhaust being caused in the retorts. Another plan is to connect the governor direct to the steam-valve of engine, and thus control the speed of the latter in accordance with the requirements of the make. Mr. Hunt's governor is self-contained, and actuates a throttle-valve of special construction, by means of levers contained inside the actuating gasholder, and connected *internally*, through the pipe which conveys the gas to the holder, with the valve-disc.

Irrespective of the regulating arrangements just noted, the exhauster is always provided with a bye-pass flap-valve, which under the ordinary working conditions is closed, but in case of sudden stoppage of the exhauster is automatically opened by the pressure of gas behind it, which thus has free vent forward to the scrubbers.

South-West of England District Association of Gas Managers.—The next half-yearly meeting of this Association will be held on Tuesday, the 11th inst., at the oil-gas works of the Great Western Railway Company, at Wormwood Scrubs, under the presidency of Mr. E. C. Riley, of Swindon, the Company's Gas Engineer. We learn, from the programme of the proceedings which has been issued by the Honorary Secretary (Mr. N. H. Humphrys, of Salisbury), that the members will assemble about noon, and inspect the works before proceeding with the business. This will comprise the consideration of applications for membership received from Mr. W. H. Green, Mr. G. M. Robins, and Mr. E. H. Stace, all of Bournemouth, and from Mr. G. W. Thomas, of Ringwood; the delivery of the President's Inaugural Address; the introduction, by Mr. D. Irving, of Bristol, of the subject of "The Federation of Gas Managers' Associations" (to be followed by a proposition thereon); and the reading of a paper on "Manipulation in the Manufacture of Gas," by Mr. W. Stagg, of Bristol. At the close of the meeting, conveyances will be in attendance to take the members to the Kensal Green station of The Gaslight and Coke Company, where the Resident Engineer (Mr. A. C. M'Minn) has kindly consented to receive them.

* See *ante*, p. 96. † See JOURNAL, Vol. LIX., p. 704.

TECHNICAL RECORD.

GAS-WORKS AS CENTRAL STATIONS FOR THE SUPPLY OF LIGHT, HEAT, AND POWER.

At a recent meeting of the Prussian Industrial Association (Vereins für Gewerbefleiss in Preussen) in Berlin Herr W. von Oechelhaeuser, General Director of the German Continental Gas Company, delivered an address on the above subject, as a "contribution to the commemorative festival of the introduction of gas lighting." We give below an abstract translation of the principal portions of the communication.

The author commenced his address by calling attention to the fact that it was just a hundred years since William Murdoch, the discoverer of practical gas lighting, illuminated his house and office at Redruth, in Cornwall, with gas prepared in retorts in his own back garden, and led by pipes to wherever light was required. After making a few remarks on the versatility and boldness of genius which Murdoch exhibited on this and in engineering matters generally, he passed on to refer to the honour done to his memory in Scotland, where a bust of him, placed among those of Watt, Scott, and Burns, was recently unveiled by Lord Kelvin,* and where, in celebration of the centenary of gas lighting, a biographical sketch, entitled "Light without a Wick," had been published. This work showed that in Murdoch's time the production of light without a wick seemed almost incredible; and, as Herr Oechelhaeuser pointed out, we find now-a-days—a hundred years later—inventors reverting to a wick of another kind, as in the Welsbach light.

Herr Oechelhaeuser then said: Let us make the following brief remarks here—firstly, that we, as Germans, may now, after a hundred years, make grateful reference to the memory of that great Scottish inventor; and secondly, demonstrate *that the inventor of gas lighting was, in fact, a genius of such calibre as to give at the same time to an industry the prototype of that apparatus which is still employed with advantage for the same purpose.* As it is with steam-engines at the present day, which still work with cylinder, piston, and, in many cases, with the ▭ slide-valve and oscillating cylinder of Murdoch, but notwithstanding have made gigantic strides, so it is with the gas industry, which still has its retorts, retort-furnaces, purifying apparatus, and gasholder. It has, so far, been impossible to replace these by anything better, though the apparatus has grown to such an extraordinary yielding capacity that I can only picture it to you in a cursory sketch. But whoever, with a technical knowledge, will wander through the new gas-works of large cities, and compare them with Murdoch's plant, will see that the difference between the two is certainly quite as great as that between our present three-cylinder engines and the first engine of Watt. At the same time, we now-a-days encounter the accusation (which, indeed, is regarded as a fact in scientific writings) that the gas industry has behind it a long period of inactivity, from which it was first aroused by the remarkable development of electric technology. Furthermore, that it had failed in its own calling, and should busy itself—in fact, ought to have done so long ago—with the supply of non-illuminating gas; otherwise electric technology will displace it in this direction also, and then there will be inscribed on its gravestone "*Hic jacet.*" These, gentlemen, are approximately the views at present entertained of the facts upon which we wish to-day to throw more light.

In order to answer the statement that gas technology failed in the necessary development of improvements before the introduction of electricity, I draw attention to the very important work which gas engineers had to conduct in the unceasing extension of their concerns without interrupting the working, and which, within from seven to ten years, commonly meant increasing the yielding capacity twofold. It is quite clear that, with this considerable work in hand, the manager of a gas undertaking could not, simultaneously with the business connected with the direction, become an inventor; just as the manager of an electricity works has not generally the time and means of discovering new dynamos, methods of distribution, &c. In addition, I will cite the final passage of a communication I made to this Association in 1878, concerning the position of the manufacture of illuminating gas at that time. In it, the most important improvements in every branch of the industry were described, especially, the then recently introduced regenerative furnaces. The final statement definitely set forth, that the internal developments of gas-works were not behind the external; and that the gas industry in Germany was just at that time in a state of most gratifying progress. This was on May 6, 1878—before any actual competition by electricity had even been contemplated; and a year later—viz., on June 9, 1879—Frederick Siemens, of Dresden, appeared before this Association in order to introduce to us his first regenerative burner, which had been connected with previous experiments in this direction.†

If, therefore, on the one hand, it is established that the gas industry was in a state of active progress in all directions in 1878, before the appearance of distributed electric light at the Paris Exhibition, so, on the other hand, it can be shown that it would be difficult to have put forth greater activity, inasmuch as, eight months after the close of that exhibition, the first regenerative burner was in use at our place of meeting.

Then followed in quick succession the Siemens regenerative burner, and the Wenham, Butzke, and other similar burners; so that anyone who was willing to pay for it could have more light. In spite of new contracts at reduced prices, or economies effected in municipal gas undertakings, the public lighting of many towns has not been improved, and up to the present day there are towns which have no better burners in the streets than they had thirty years ago. This was, however, no fault of the gas manufacturer; for he was always willing to place more burners in the street lamps, or to furnish them with improved burners. But some external influence was required to make the public pay more for more light; and really gas makers ought to be thankful to the electrician for giving the public taste the impulse for better illumination at a higher price. But again the question of cost had prevented the extensive introduction of electric lighting; and perhaps the much-abused gas lighting might yet step in with its Welsbach lights, &c., to furnish the desired improvement in the way of public lighting with the necessary cheapness.

In statements against the gas industry, said the author, prominence is also given to the reproach that gas people are too indifferent, and have too much of a monopoly to use cheaper methods of producing their gas. More especially, they have neglected to manufacture water gas, and to supply a cheap heating gas in special mains as well as illuminating gas. It is opportune here to make some remarks about this reproach. The water-gas question occupied the attention of gas makers for some time before the appearance of scientific publications about it; they having become acquainted with it by travelling in America, and by means of experimental works. Gas makers would be only too pleased to avail themselves of any advantages it would offer. All the points in the *technique* of its manufacture have been investigated in America, and the conclusion arrived at is that it is not suitable for Germany, where the conditions are adverse. In America they have not good gas coal; but they have anthracite coal, which is just the thing for making water gas. They also have their vast supplies of petroleum for carburetting the water gas, and bringing it up to any desired standard of luminosity; and inasmuch as the duty on petroleum in Germany is 6s. per 100 kilos., this fact alone renders illusory any idea of water gas competing successfully with ordinary gas in the country, and therefore as long as the present conditions exist the manufacture of carburetted water gas cannot be contemplated. But now we are further advised that, on account of the lack of prospects of our competing in lighting, we might relinquish the manufacture of illuminating gas, and only send out non-illuminative heating gas at a low price. However, closer examination and practical considerations show how difficult it would be. In the first place, to make the manufacture of heating gas pay, inasmuch as it has only slightly more than half the heating power of ordinary coal gas, and would require more extensive plant and mains larger than those now in use, it could scarcely be delivered cheap enough to compete for heating rooms, houses, or factories. Secondly, it would be difficult to set aside, without a prolonged struggle, the enormous capital sunk in private and central heating installations, furnaces, stoves, and fireplaces; and experience hitherto acquired, teaches us that economical gas firing requires special appliances, and that the retention and alteration of existing fireplaces for the purpose results, in by far the greater number of cases, in a waste of gas, which renders impossible any prospects of success for a central station in general competition with independent heating and solid fuel. Thirdly, there seems to be no prospect of obtaining permission to lay a second set of pipes, when every day it is becoming more evident that light, heat, and power can all be delivered through a single system of mains, especially where central distribution is possible.

The following points perhaps furnish further support to these statements: The proceedings of the meeting of gas managers at Detroit in May last* are very instructive on this point. It is satisfactorily demonstrated by them that a heating gas, in order to replace all other firing, and not be restricted as is the case of heating with coal gas, to particular circumstances and specially constructed economical appliances, must be produced of an equal heating power at a purchase price very considerably below that of coal gas. All companies who have tried it up to the present time in America have given it up, even the great water-gas works—a fact which is specially worth noting; so that at present, as far as I know, there is only one single company continuing this industry. It has three works—among others, one in Hyde Park, Chicago; and therefore, on the occasion of the forthcoming Exhibition, one will have an opportunity of studying the experiments closely, and of comparing the results with the economical conditions at home. Moreover, setting aside the failures economically of all undertakings for heating with gas, the greatest difficulties of all were encountered in the production, supply, and distribution of gas for this purpose; for, according to American experience, the variations in the gas supply due to changes of temperature alone are so great that, for example, the day's consumption during summer is quadrupled in the winter, and in cases of suddenly increased cold, the consumption has gone up with great

* See JOURNAL, Vol. LX., p. 203. † *Ibid.*, Vol. XXXV., p. 60.

* See JOURNAL, Vol. LX., pp. 74, 157

rapidity, and has even doubled itself within 24 hours. It will be at once evident what very enormous gasholders, and what vast reserves, would be required if it were desired to do all heating with gas sent from a central station. In many places in England one has experienced the unfavourable effect on the production and supply of gas, of the delivery of too much gas for heating purposes, which moreover renders necessary the erection of larger holders. On the other hand, statistics of the German Continental Gas Company show how exceptionally regular the consumption of gas for power and cooking is.

We come, therefore, to the conclusion that, in the first place, supplanting all present firing by a gas supply is a chimera, and secondly, that it is from all points of view advisable to await the results of the most recent American experiments before proceeding to make, along with illuminating gas of high heating value, a less valuable non-illuminating heating gas. These conclusions are arrived at from technical and economical experiences; and are not the result either of any inactivity in the gas industry, or of any monopoly.

Central Stations for Heating.

Passing on to consider gas-works as central stations for heating, the author said: As a matter of fact, in places suitable for a central service, and where advantages other than the mere question of cost come into consideration, ordinary coal-gas has been supplied for heating purposes, and has been so eagerly adopted that it is next to impossible to enumerate here the many purposes to which it has been applied in works and factories. In Denmark, there are many towns in which, of the gas supplied by one system of pipes, more is consumed for heating than for lighting; and it is nearly the same in Germany. For example, in Tilsit, the price charged for gas for heating and cooking is 13 pfennige per cubic metre, while for power a further reduction of 10 per cent. is allowed. Wherever this practice has been introduced, it has demonstrated that it is a great mistake to believe that the price of the gas alone is the main point. Providing new heating and cooking appliances, and using them in a rational and economical manner, are at least as important and present much greater difficulties. From the report of the proceedings at the American meeting already referred to, Herr Oechelhäuser gathers that, without this economy in consumption, there can be no success, even when there is a supply of natural gas, as in Pittsburg. The price of gas is therefore only one factor among many of equal importance. As, however, there apparently is a firmly-fixed impression that such central stations for the supply of light, heat, and power are best conducted under municipal control, in order to protect the interests of the public, reference to the popular case of his Company's management is here introduced.

The German Continental Gas Company so far showed their appreciation of the great importance of the application of gas to heating and cooking, that, as far back as 1868—that is, 24 years ago—they voluntarily granted to those towns contracting with them a reduction of from 25 to 30 per cent. for gas employed for heating and motive power. This gradually brought down the price of this gas to from 14 to 9 pfennige per cubic metre. In the Company's circulars of the period—among other things announcing the introduction of gas-engines—great stress was laid not only on their own interests, but also on the idea of aiding small factories, and their powers of competing with the greater works; and besides a reduction in prices, every facility was afforded for providing and erecting appliances and engines. It was only later on that municipal gas-works made similar reductions in the price of gas used for heating and motive power; and, finally, 18 years after—viz., in 1886—it required the further energetic example of the Düsseldorf authorities, which was followed by other municipalities, before this measure in the interests of those engaged in handicrafts became general. It is a matter for congratulation that the German Minister of Commerce, who at the time alluded to was President of the Düsseldorf Government, has now taken in hand the "smoke nuisance" question; and there is thus a prospect of its being at last transferred from mere academical discussion to actual practice, and our great towns prevented from gradually making the acquaintance of the celebrated London fog. As regards this question, we gas people do not in any way hold the opinion that general welfare is only to be attained from central gas supply stations; but we believe that, with the energetic support of the authorities, not only would the hygienic condition of the inhabitants be improved by cooking, ironing, and part heating by gas, but also that, by the more extended use of our bye-product coke, which burns absolutely without the generation of any smoke, a great relief would accrue to the towns. No one would think of turning petroleum into gas, and delivering it in pipes to the house for burning, inasmuch as everyone possesses in his own lamp the simplest gasifying apparatus; and in just the same way gasifying coke at a central station could not compete with that simple gasifying apparatus, the closed stove adapted for consuming small coke.

The speaker could not undertake to repeat the special advantages of gas firing for cooking and heating as set forth in all prospectuses; but he wished to refer to one gratifying fact from his long and varied practice—viz., *that it is the less opulent middle class who are most eager to avail themselves of the benefits of gas firing.* In those places where the mistress of the house does her own cooking, and has but little help, the price of gas does not compare with that of ordinary fuel. But then there is the saving of time and labour in fetching coal and removing ashes; there is the gain of space in kitchen and cellar; there is the avoidance of heat in the small kitchen in the summer; and, lastly, there is the comfort of having a fire always ready and no trouble in regulating it easily and economically. There is no greater error than to suppose that gas firing is only for rich people; for, on the contrary, it could be proved by innumerable examples that no people understand and use it so well, and in such large quantities, as the economical middle class. Gas-stoves, as distinct from cooking appliances, have been employed more extensively than the Company expected, because they, as a rule, only recommended them for auxiliary heating, or for rooms which are seldom warmed, but need to be heated quickly as occasion requires.

As already stated, gas is employed in works and factories to a much greater extent than is generally assumed. Many operations requiring a large quantity of gas are frequently kept secret, so that even the gas-works officials have no exact information of the character of the application. This is where the spirit of enterprise and the intelligence of the manufacturer come into play, and make him take advantage of the great benefits of gas firing at the present low prices. Many industries utilize double muffle furnaces heated by gas, so that a fixed and constant temperature may be maintained; as, for instance, for burning-in enamels. Some kinds of tobacco are prepared in digesters kept at a constant temperature by means of Bunsen burners of large size. Type metal is quickly melted by gas in pots holding 6 cwt. apiece. Gas-fires are used by all German railways for putting on the tyres of their railway-carriage wheels. Following a suggestion arising out of the interesting experiments of the State Physico-Technical Institution on the restoration of the colour of steel by means of gas, the German Continental Gas Company have constructed at their central works an annealing furnace for tools, &c. Apparatus with as many receptacles as may be desired, and fitted with gas appliances, are used in kitchens for workmen; enabling them, while they are working, to cook or keep hot the food they bring with them. The general application of gas for ironing, either in the domestic or the public laundry, is known; and this is one instance out of many where, besides other advantages, gas is absolutely cheaper than any other fuel.

Briefly, then, coal-gas works, even at present prices, suffice perfectly as central stations for supplying heating material where it is requisite to have the temperature perfectly under control, as in house heating, tempering, drying, pressing, incinerating, burning in, or where it is required to divide the heat, or to apply it at a special point, as in soldering, welding, singeing, &c., or to avoid heat and smoke, and have a comfortable, convenient, and clean fire. We do not lay ourselves out for furnishing heat in large works; and just as the greater cost of electric light brings with it other advantages, so, in the field of heating at least, may illuminating gas be regarded as the aristocrat.

Central Stations for Power.

If we now turn to the consideration of gas-works as central depôts for supplying power, we at once find, in theoretical discussions on the subject, that gas distribution has not hitherto found its proper position. We must therefore bear in mind that gas-works can justify their claim to be regarded as centres for supplying power by actual practice of now nearly 25 years' standing.

In reply to questions put by him two years ago to 46 different firms, who mentioned gas-engines in their catalogues, the speaker obtained from 20 firms the desired information about the number and size of the engines supplied. According to this information, there were in operation in Germany about 18,000 gas-engines (exclusive of petroleum engines), with, in round numbers, a total power of 60,000 horse power, or an average of 3½-horse power each. Since that time—two years ago—the two largest manufactories of gas-engines alone have supplied 1950 gas-engines, of a total of 8830-horse power, averaging 4½-horse power per engine. So that, at present at least, 70,000 horse power is furnished in Germany alone *by the use of coal gas as fuel.* It is interesting to compare this number with the contemporaneous power supply by steam-engines for working dynamos. The accurate records of the State Bureau are available for this purpose for the kingdom of Prussia; and in that country, at the commencement of 1892, steam-engines supplied 69,087 horse power for the working of dynamos;* so that the gas-engines operated from the gas-works in Germany with at least 70,000-horse power could supply all the power now furnished by steam required for electricity in Prussia. When considering this, it must not be forgotten, as regards a large number of

* Besides this, there are numerous electrical installations furnished with gas-engines. The Deutz Gas-Engine Factory alone announces that there are 1000 electric light installations, with 12,000-horse power, supplied by Otto's new gas-engine. The suitability of gas-engines, under certain circumstances, for use in small and medium-sized electrical stations, and the interest which can accrue to gas-works by collaboration with electric work, are thoroughly set forth by the author in a memoir entitled "Bericht uber den Betrieb der Elektrischen Centrale Dessau, in den Jahren 1886-91," read on the occasion of the Electrical Exhibition at Frankfort-on-the-Main (see JOURNAL OF GAS LIGHTING, Vol. LIX., pp. 21, 67). On some future occasion, the fact that gas-engines are also suitable for alternate-current installations, with or without steam-engines, will be discussed.

towns, that the possibility of introducing gas-engines on account of cheaper gas has only arisen in recent years.

The gas industry has, therefore, a perfect right, in this its hundredth year, to be proud of the development of gas-engine technology, which is 25 years old; and German gas industry has special claims on this point, inasmuch as the first vital and practically useful impetus was given to this industry by the genius and activity of Langen and Otto in Deutz. Their new make of "Otto" engine was such a perfectly constructed engine, that its original strong, firm, and elegant form has become a prototype for the whole gas-engine industry. The result is that not only has the size of gas-engines increased during the last six years from 60 to 120 horse power, but that there are now whole series of good patterns and good makers; and the best recommendation for the gas-engine industry is that, according to the author's experience, every owner of an engine is most satisfied with just that system which he himself has. The manufacture of gas-engines is making rapid progress in quality, economy, and cheapness. Tresca found that the old Lenoir engine of 1861 consumed 3·5 cubic metres of gas per horse power; and for many years afterwards people were satisfied with the convenient computation that 1 cubic metre of gas per hour developed 1-horse power, whereas now-a-days an economical consumption of about 800 litres may be reckoned per effective horse-power, even in small engines ranging from 2-horse power, while the larger engines are warranted at 650 litres with the normal 16-candle coal gas.* Therefore, in future, if comparative calculations with steam-engines and electromotors are to be made conscientiously, from 700 to 800 litres must be substituted for the convenient valuation of 1 cubic metre per horse power per hour. It can with certainty be predicted that this number will before long represent the average consumption of all larger gas-engines, whatever the load. But, what is more, it is highly probable that, in the near future, gas-engines of 500-horse power, with single or double cylinders, will be constructed, requiring only 500 litres of the ordinary 16-candle gas per effective horse power. The views expressed by Slaby and Schöttler in Germany, by Witz and Tresca in France, and by Clerk, Jenkin, and Robinson in England, on the brilliant future of the gas-engine—views founded on most comprehensive theoretical researches and classical practical experiments—will become facts sooner than people would presume, and will afford a splendid example demonstrating how theory and practice can help one another.

If, however, gas-engines are already spread about very extensively (of those on the "Otto" system alone there are more than the equivalent of 150,000-horse power), and are therefore a very definite institution, how does it affect the gas-mains? Can gas-works generally become suitable power-supplying stations? This question depends, first, on *technical* and then on *economical* possibilities. The larger gas-works in Germany supply systems of mains of a total length of from 200 to 1000 kilometres (125 to 625 miles); and to force the gas through them entails at the most a loss of pressure amounting to 80—25= 55mm. ($2\frac{8}{16}$ inches) of water, or about 1-18oth of an atmosphere. For example, the municipal gas-works of Berlin (exclusive of the English works) convey about 65,000 cubic metres of gas per hour with a probably smaller loss of pressure, and, of course, a smaller consumption of power. If one calculates, on the basis given above, a consumption of 0·7 cubic metre of gas per effective horse-power of a gas-engine with a brake on its shaft, then the Berlin municipal works would alone be able to furnish about 93,000-horse power, which amounts to about one-third more power than all the steam-engines used at the present time in Prussia for electrical energy. In a short time Berlin will also have a distinct distribution of gas power in the two lines of mains of 845 mm. ($33\frac{1}{4}$ inches) in diameter, and 4·7 kilometres (about 3 miles) long, which are intended to connect the large new gas-works in Schmargendorf with the holders in the Augsburgerstrasse. These two mains will together be capable of conveying 18,000 cubic metres of gas, or at least 25,000-horse power per hour, and will therefore only require a net force of about 5-horse power in order to attain with exhausters a higher initial pressure of about 1-40th of an atmosphere. Therefore the whole conveyance of 25,000-horse power over a distance of 4·7 kilometres will be effected with an expenditure of force of 1-5000th.† To quote the largest practical example on this point, 85,000 cubic metres of gas, capable of producing somewhere about 120,000-horse power, are conveyed hourly from Beckton to London—a distance of about 8 miles—through two cast-iron mains 48 inches in diameter. This gigantic transport of gas is effected by means of exhausters of 120-horse power, with a loss of pressure of about 600 — 150= 450 mm. of water, or only about 1-22nd of an atmosphere. Therefore this transport demands about 1000th of the power conveyed. The conveying capabilities of gas-mains therefore increases considerably where an initial pressure of 600 mm. of water, or 1-16th of an atmosphere, is used, which can always be employed, even, for example, when strengthening old mains. Amongst other experiments, those of Mr. E. C. Riley show that coal gas, under a pressure of about $1\frac{1}{2}$ atmospheres, or 20 lbs. per square inch, loses only 0·37 per cent. of its lighting power;* so that it is not impossible that, for lighting purposes, gas may be given a pressure of one atmosphere in order to have the mains of still smaller diameter for long distances.

If, therefore, the present systems of gas-mains possess a capability of conveying power in bulk, in a way that no other system of transporting power has hitherto exhibited in practice, gas-works have yet another special "pull" over all other systems—viz., that of the vastest and cheapest store of power. This, as is well known, is of great advantage for the regular utilization of the power installations in the 24 hours of a day, and will become all the more important as the number of the large and intermittent engines included in a distributing system increases. This possibility of a vast storeage of gas is even more important when considering its application to heating purposes than to the distribution of force; for, as we have seen, changes of temperature are of a suddenness and magnitude rarely approached in the mere supply of light and power. A central station which cannot store heat and power in large quantities is technically and generally a matter of anxiety, as from the moment that heat and power commence to constitute a considerable factor in the subdivision of the energy, it can scarcely be conducted economically because of the extensive engine and retort reserve required.

Taking Berlin as an example in this case also, up to the present time all the gasholders together have a capacity of about 650,000 cubic metres, so they can store up some 93,000 horse power for ten hours. In London, again, gasholders have a total capacity of approximately 4,000,000 cubic metres, representing a reservoir of 500,000-horse power, which could be sustained also for ten hours.

The following comparisons demonstrate the relative cheapness of this storeage of light, heat, and power: A battery of electrical accumulators capable of giving 140-horse power during four hours, or 560-horse power for an hour (the largest battery at present laid down), costs about 70,000 marks (£3500) for construction, &c.; that is, about 125 marks (£6 5s.) per horse power per hour. Gasholder accommodation for 560 horse-power-hours amounts to about 400 cubic metres, and would cost, in small town gasholders, about 10,000 marks (£500), or 17·8 marks (about 17s. 9½d.) per horse-power-hour. But in the most recent London gasholder,† an expenditure of only about 1400 marks (£70), or 2·5 marks (2s. 6d.) per horse-power-hour, was needed. Hence electrical storeage with accumulators having the present day capacity is 7 to 50 times dearer in comparison with the gasholder. In spite of the high cost of installing and the great loss attached to electrical accumulators, they have been shown to be of considerable advantage in working continuous current installations.‡ But, in gas distribution, the small cost and losses have yet to be added to the low price of storeage for light, heat, and power.

The Cost of, and Loss in, Distribution.

The cost of distribution in towns, including house connections, amounts, in the case of the German Continental Gas Company, to a sum of about 16 marks per light, according to the present prices, from an average of twelve systems of mains, which extend over a large area in 32 towns and districts, and which have one light to every 2 metres laid. According to Upperborn, a system of cables for electric lighting costs 50 marks for each light installed. From these facts, the cost of laying down gas-mains, in the example quoted, is only one-third that of similar electric light cables. For an alternate-current system of electric lighting, the construction of a central station amounts to about 30 marks per light; and even in this instance, the cost of the gas-main system would be about half as much as the electric lighting system. If, however, the gas-main and electric cable systems are regarded as simple means of conveying force, then unfortunately, we have, up to the present time, no exact statistical data as to the cost of distributing electric power from central stations. But, in order at least to obtain an approximate comparison—not of the absolute cost price, but simple comparative figures—the assumption is made that as gas-mains and electric cables increase in capacity, the cost increases to the same extent; and in a great number of instances this will undoubtedly be true. In the case of the German Continental Gas Company, mentioned above, the quantity of gas consumed per light during the busiest hours on the days of maximum consumption, averages 70 litres per hour; while for every horse power supplied, it is 400 litres. Therefore, on this assumption, the proportional figures for the

* In the Dessau Central Electric Station, utilizing 160 to 180-horse power furnished by "Otto" gas-engines, the average consumption per effective horse power in 1887 was 953 litres of gas; in 1891 it was only 730 litres. The Deutz gas-dynamo of this station, 120-horse power (with Fritsches' dynamo), develops in 145 revolutions with 1 cubic metre of gas 905 watts; therefore with 60·7 litres of gas it sustains the incandescent lamp of 16 candles and 55 watts. The firm of Körting Bros., of Hanover, claim that, with the gas-dynamo they make as a speciality, "the consumption of gas, in the larger engines, per 16 candle incandescent lamp per hour, is reduced to about 60 litres."

† Calculating the duty of the exhausters (since the projected plant is not yet laid down) at only 25 per cent., they will then require about 20-horse power; and then the expenditure of force would be 1-1250th, and could be placed in direct comparison with that of the Beckton works, which is the example quoted.

* See JOURNAL, Vol. LIX., p. 749 *et seq.*

† The new six-lift gasholder of the South Metropolitan Gas Company at East Greenwich, in which the two top lifts rise without any supporting framework, has an external diameter of 300 feet, a total height of all six lifts of about 175 feet, and a capacity of 12 million cubic feet. The cost, according to a communication by Mr. Frank Livesey, amounted to about £5 per 1000 cubic feet.

‡ See the report on the Working of the Dessau Central Electric Lighting Station, 1886–1891 (JOURNAL, Vol. LIX., pp. 21, 67.)

distribution of power would be $\frac{400}{70} = 16$, or about 90 litres for each transmitted effective horse power. Taking for the basis of calculation of the consumption per lamp in the electric power system for conveying power on a day of maximum consumption at the busiest hour, at 60 per cent. of 55 watts—*i.e.*, about 33 watts—and, in like manner for the gas motor, taking the consumption of a horse power at 400 watts (inasmuch as the litre and watt are interchangeable at the present time), then the proportional number gives $\frac{400}{33} = 50$, or about 600. Again, therefore, the cost of construction for the distribution of power by the three-conductor system, under the conditions given, amounts to about 6·7 times that of gas. For the alternate-current system, the proportionate figures, under the same conditions of consumption, would amount to $\frac{400}{33} = 30$, therefore about 360, or four times higher than that of gas. In all these cases, it is assumed that light and power are distributed by the *same* system. For the simple transmission of force as well as for conveying it great distances, both gas and electricity would show very much better results, as soon as it becomes a question of distributing power over long distances in or between towns. For example, it is stated that the cost of the transmission of each horse power in the double main between Schmargendorf and Berlin is only 30 marks per horse power transmitted. When the total loss in transmission is considered, the advantages are just as great as those derived from gas-works for the simultaneous supply of light and power.

It is here briefly remarked that, in most cases, altogether false views are held as regards the leakage from gas-mains. The total loss is made up of about five factors altogether, among which the loss by leakage is only a fractional part. In a great number of towns in which the mains have for the most part been in the ground for more than 30 years, and in which the results may be regarded as representative, the total loss amounts to between 2½ and 7 per cent., according to the statistics relating to the German gas and water industries for 1890-91; and in the 13 systems of mains of the German Continental Gas Company, it amounted in that year to 4·4 per cent., and in 1891-2 to 5·51 per cent. Of these losses, on an average, only about 2 to 3 per cent. can be attributed to leakage from the mains—for lines of pipes can be so laid as to be absolutely gas-tight when they are not disturbed. For example, many mains of considerable length, connecting gasholders in neighbouring towns, are under a very much greater pressure than that ordinarily employed for the distribution of gas in towns—such mains being, for instance, 4 kilometres in length and, after being in use for many years, they have not shown signs of any measurable loss of gas. Besides leakages in pipe-joints and branches, and from occasional flaws, there are other sources of loss, one of which is that a portion of the aqueous vapour, naphthalene, &c., contained in the gas becomes condensed in the mains. A third cause of loss arises from the fact that the gas-meters are mostly in colder places at the point of consumption than are those at the gas-works; so that, owing to this difference, the meters registering the consumption record a smaller quantity of gas than those at the works. A fourth source arises from the fact that the gas used in the public lamps is not measured by separate meters, but is reckoned on the basis of an average consumption. The fifth cause is that, in order to avoid disagreement, a larger quantity of gas is supplied for public lighting purposes than is actually paid for. As regards the diffusion of air and gas through wrought-iron pipes, as far as I am aware this has never been substantiated; and therefore it ought not to be looked upon as anything more than a mere hypothesis when considering the known sources of loss. Besides, the fact is specially worthy of being brought forward, that the larger the mains, and the greater the amount of power transmitted, the smaller would be the proportional loss attributable to leakage. While the quantity of gas transmitted augments approximately with the diameter of the pipes, the amount of leakage increases with the circumference; and similar favourable conditions are with the cost of construction. The total loss in a carefully maintained system of mains cannot be taken, at the highest, at more than 6 or 7 per cent.; and for certain long-distance mains without branches, only at 0 to 1 per cent. The small loss of pressure in transmitting—amounting to about 1-180th of an atmosphere—need not be taken into consideration, first of all because of its small proportion when compared with the power transmitted; and secondly, because the cost of generating this pressure is generally already included in the cost of the gas pumped into the holder. A result of 97 to 93 per cent., and of at least 99 per cent. in long distances, of the power distributed from the central station as in the actual distribution of gas-works, has hitherto not yet been proved in other systems of distributing power as the average annual result.

There are no known data relating to the average annual loss of central stations relating to compressed air and electricity, including all the losses from leakage, insulation, and measurement; and, indeed, they would be very difficult to substantiate. The possibility of settling these questions accurately is a great advantage as regards gas-works. We can therefore very well take it as proved that the transmission of power in the form of gas can be undertaken, not only for consumers in towns, but also for distribution at a considerable distance; and that economical results can be obtained thereby, with a very low cost of construction and working. Even under circumstances where it would not be profitable to lay down gas-mains to supply new installations of large gas-engines (for instance, those of more than 100-horse power), or if the price of gas were high, the Dowson gas apparatus, or some similar plant, would be available. For such plant, an exceptionally good fuel, in the form of crushed and washed coke, could be supplied from the gas-works. It has been established, by a number of extensive practical experiments carried out at the Cambrian Mills, near Newtown, Montgomeryshire,* that, with an installation of gas-engines having a total of 280 effective horse power, when simply working up to an average of 190-horse power 0·558 kilo. of anthracite or 0·785 kilo. of coke was required per effective horse power. This is the fuel utilized by engines which nearly approach the efficiency of the large three-cylinder steam-engines, and sometimes even surpass it. But we do not at all pretend to supplant generally the steam-engine; for, in the first place, gas is not to be had everywhere; then in some cases gas is supplied for motive power at too high a price; and, finally, many small motors (amongst others, those actuated by compressed air or by electricity) are better adapted for a large number of purposes than gas-engines. Those applications as regards electric motors have been recently described in a very interesting manner by Herr E. Hartmann.†

Before, however, quitting the subject of the distribution of power from gas-works, it was remarked that Herr Junkers, of Dessau, had succeeded in constructing a calorimeter by which one could ascertain the heating value of combustible gas, not only in an extremely short time, but also with sufficient accuracy for practical purposes. It is therefore possible that, in future, manufacturers of gas-engines will be able to give the heat requirements of their engines accurately in calories instead of in cubic metres, inasmuch as the latter is only a question of capacity and not of value, and the heating powers of different coal gases vary considerably from one another in different places. At the present time, therefore, we have arrived at the measurement of the heating value of gas; and it will be able to be compared in different towns in a much more satisfactory manner than in the case of the measurement of light with the photometer, even though there is in the instrument recently constructed by the State Physico-Technical Institute at Charlottenburg, Berlin, a photometer which for accuracy, and for the possibility of comparing lights of different colours seems to be absolutely unrivalled.‡ However, the eye of the observer always remains in this case the comparing agent; whereas with the new calorimeter the necessary operations consist of two simple readings of temperature, one weighing of water, and one measurement of gas. The multiplication of the difference of temperature into the quantity of water, and dividing by the quantity of gas, gives directly the heat-value of the gas in calories.

If, therefore, gas-works are fully developed on both technical and economical sides, in accordance with the requirements for power, then, on the other hand, an experience in gas distribution of upwards of 20 years' standing shows that the demand for small engines for trade purposes will be either very considerably over-estimated or at least one overlooks in this case that the cost of the motive power is not the only consideration, but that the application of mechanical power ordinarily necessitates complete changes in tools and modes of working. This entails extra cost for construction; and, above all things, a spirit of enterprise enters into the consideration, and does not permit of such speedy development of mechanical power in trades in reality as on paper. The immense labour that those who have the management of gas-works have had to bestow on the introduction of gas-engines during 20 years' activity is a proof of this; and so also is the very small and diminishing number of electro-motors which have been introduced into trade in spite of many years' agitation.

(*To be continued.*)

THE COMPARATIVE COST OF GAS AND ELECTRIC LIGHTING.

References have recently been made by our Scotch Correspondent to a paper on the above subject read by Mr. J. M. TURNBULL, of Edinburgh, before the Merchants' Association of that city. We give below the principal portions of the communication.

In view of the recent adoption of the electric light by many towns, and its proposed introduction into Edinburgh, the present may be considered a very suitable time to consider its advantages and disadvantages, and what it is likely to cost as compared with gas lighting as we already have it. First, as regards the cost. As it is proposed to treat the subject from the consumers' point of view only, it is not necessary here to go into the cost of engines, dynamos, and other fittings required for an installation. We need only take it as charged to consumers, like any other article supplied commercially.

It is somewhat difficult to arrive at what would be an average price for electric current, as estimates for proposed installations, and the prices charged in localities where it has already been introduced, vary so much. To get at this, and to come to as fair a conclusion as possible, I will take the estimates and

* See JOURNAL, Vol. LIX., p. 20.
† *Zeitschrift des Vereins Deutscher Ingenieure*, 1892, p. 1113 *et seq.*
‡ See *Zeitschrift für Instrumentenhunde*, February, 1892.

statements of electricians themselves, and also the actual prices charged in towns in which the electric light is already in use. As technical knowledge concerning electrical matters has hitherto been confined to a few, it has given room for many parties whose knowledge of it was exceedingly small to talk a great deal of mysterious nonsense and sentiment regarding it; and, if these statements were believed, there is hardly anything that electricity would not accomplish. As, however, knowledge concerning it is being very rapidly extended, the proper and most economical uses it can be put to are being found out, and the sentiment and humbug formerly talked about it will shortly disappear. When any of the authorities in electrical matters are asked as to its cost for lighting, the answer is generally very indefinite. If an approximate answer is given, it is generally "about the same price as gas;" "about 10 per cent. dearer than gas;" "taking it all round, it will not quite compete with gas." Some electrical engineers have even stated it as "about 30 per cent. dearer than gas." In order to show how neatly the question of cost is evaded by electrical experts, I will quote from the prospectus of a company recently promoted for the supply of electricity to Coatbridge: "The question of the price at which the current could be supplied has been the chief one raised by intending consumers. They are willing to pay the present price of gas, light for light. In this connection, the following figures, given by Mr. W. H. Preece, Chief Electrician to the Post Office, in a recent address, will doubtless be of interest: 'A pound of coal distilled into gas (in Manchester) gave a light of 17·2 candles, while a pound of coal converted into electrical energy would give 48 candles with a glow light, and 288 candles with an arc light.'" In the same address Mr. Preece also stated, as a result of his practical experience with more than 70 lamps, that "he was not paying more than when he had gas-burners." It will be observed that they do not (although they quote the price per unit in six other towns) give the price at which they intend to supply the unit, but round off their indefinite statement by an entirely misleading quotation from an address by a scientific man. Mr. Preece neglects to state that there are residuals in gas manufacture. In Edinburgh, last year, coal for the gas-works cost £112,975; but, out of this, there was recovered for residuals £26,686, or 26¼ per cent. Now, if an engineer who is asked to give an estimate were to neglect to take 26¼ per cent. into consideration, you would say that he was misleading you; and I say that Mr. Preece is not stating the case fairly. If the prices which have been fixed in the towns in which electric light has been introduced are taken, the cost at which electric current can be at present supplied will be arrived at. I take the prices charged in 15 towns, and the average comes out at 7½d. per unit; but that there may be no stretching of the figures, I will take 7d. as the unit. In order to make a fair comparison with gas, I will take one of the best-known forms in which the electric current is used—that of the 16-candle incandescent lamp, which is known as the 60-watt lamp, because 60 watts passed through it per hour at 100 volts pressure will give a light of 16 candles. I take the supply of current for 1000 hours, which may stand for about a year's lighting. A Board of Trade unit is made up of 1000 watts; therefore it follows that in 1000 hours a lamp will require 60 units. These at 7d. per unit will cost £1 15s. This is not, however, all the cost. The lamp requires renewal. In view of the early expiration of patents, I will take the cost of a lamp, with the fixing of it, at 2s. 6d. But there is also the charge for a meter. Not to overstate, I will take the lowest hire I know of—that which it is proposed to charge in Dundee—of 15s. each. Taking an average of ten lamps in a house, the charge upon each lamp would be 1s. 6d. In Liverpool it would be 3s. Adding the above figures together, we have a total charge of £1 19s. per lamp.

Now, as regards gas. The gas used in London, and in many other towns in England, is of 16-candle power; and it is charged at from 1s. 9½d. to 2s. 6d. per 1000 cubic feet—the average charge, taking a number of towns, being 2s. 2d. Not to strain the matter, I will take the highest charge of 2s. 6d. If 16-candle gas be burnt at the rate of 5 cubic feet per hour, it will give a light of 16 candles. It will take 5000 cubic feet to last 1000 hours; and this quantity, at 2s. 6d. per 1000 cubic feet, will cost 12s. 6d. But as in Edinburgh the gas in use is of 26-candle power, 615½ cubic feet of that gas will give a light equal to 1000 cubic feet of 16-candle gas. Therefore, 3077½, or, to put it in round numbers, 3100 cubic feet of Edinburgh gas, will be equal to 5000 cubic feet of 16-candle gas. Charged at 3s. 10d. per 1000 feet (the present price in Edinburgh), the cost would be 11s. 10d.—say, 12s. The light from the electric lamp would therefore cost £1 7s. more than that from the gas-lamp. Electricity at 39s. per lamp is consequently 3¼ times dearer than gas at 12s. With regard to incandescent lamps, however, many of them do not give the light they are said to afford, even to begin with; and before they have been long in use, their light is diminished by one-half, or even more. If this serious depreciation be taken into account, it will increase the cost of lighting by one-third or one-half; and it may easily be said, without stretching figures, that the expense of lighting by incandescent electric lamps is from four to five times that of lighting by gas.

A favourite delusion, both with those who know little about electricity, and also with those who know better, is that, if they have a private installation, and generate current by means of a gas-engine, they will produce light much cheaper than if they lighted by gas. That this is a delusion, I will prove by a case that happened very recently. Some months ago, the Safe Deposit Company's vaults in London were lighted by gas; there being a steam-engine at hand which was kept going for ventilation purposes. It was resolved to attach a dynamo to this engine, to produce current for lighting. Some statements were made in the JOURNAL OF GAS LIGHTING as to the cost at which the current was produced; and these were controverted by Mr. A. B. Gill, the Engineer under whose superintendence the Safe Deposit premises were lighted. I will not enter into this. But Mr. Gill also stated that he had a private installation, worked by a gas-engine, at his own house, and that he produced current at a cost of 1½d. per unit, and that the current lighted 16 lamps of 16-candle power each; the gas consumed being 50 cubic feet per hour, at 2s. 6d. per 1000 cubic feet. Whether he made these statements to deceive other people, or whether he was deceived himself, I cannot say; but that he was utterly mistaken I will undertake to prove. In the first place, it would require a 2-horse power engine, working to 3-horse power, to produce that amount of current. The cost of engine, dynamo, lamps, wiring, and fitting up would be at least £150, the interest upon which, at 5 per cent. per annum, would be £7 10s. If 50 cubic feet of gas per hour were used, it would require, in a year (which, to give him every fairness, I will take at 1250 hours), 62,500 cubic feet. This, at 2s. 6d. per 1000 cubic feet, would cost £7 16s. 3d. In a great deal less than twenty years his engine would be pretty well worked out; and therefore 5 per cent., or £7 10s. a year, would require to be added. Other £7 10s. would be needed for oil, repairs, &c.; and £2 10s. 8d. for renewal of lamps. These figures run up to £32 16s. 11d. Now, with gas, 16 burners consuming 5 cubic feet each per hour, would in 1250 hours use 100,000 cubic feet, which, at 2s. 6d. per 1000 feet, would amount to £12 10s. Add £1 as the cost of burners and for depreciation of fittings, and the cost of the two lights would be: Electricity, £32 16s. 11d.; gas, £13 10s.; or a difference of £19 6s. 11d. per annum in favour of gas. To put it in another way, he requires 2500 Board of Trade units for his 16 lamps; and, in order that his lighting bill should be no more than it would be by gas, he would require to be able to produce current at a little less than 1¼d. per unit, which would come to £13 0s. 5d. Here is another example of how electrical engineers compare electricity with gas. Mr. Robert Hammond is the author of a book entitled "Electric Light in Our Homes;" and in it he reckons up the cost of running electric light in the First Avenue Hotel as follows: "Average of 230 lights per hour throughout the year—Wages, £450; coal, £400; renewal of lamps, £200; sundries, £200; keeping plant in perfect repair, £600—total, £1850. Cost of illumination by gas—Average number of lights per hour throughout the year, 230; 24 hours × 365 days × 6 cubic feet of gas = 12,088,800 cubic feet of gas, at 3s. per 1000 cubic feet, £1813 6s. 4d." He does not allow anything for interest or depreciation, which would be about £300 more; while the cost of gas, burning for 3000 hours, with 16-candle gas at 2s. 6d. (not 3s., as he says), would be £512, or less than a quarter the cost of the electric light. But it will be observed that he counts upon gas burning for 24 hours per day. With the arc light, much better results are obtained for the quantity of current used.

As to the cost of current, I will take two recent examples—Brighton and Glasgow. At Brighton, estimates were taken for 40 arc lamps to light the Marine Parade. These lamps were to use 30,000 units per annum, at a cost of £875. Each lamp would thus use 750 units, and would in all cost £21 17s. 6d. In Glasgow, the charge for each arc lamp has been fixed at £20. In neither of these particular cases can the charges be given as the results of practical trials; but in Bradford, where the light has been in use for some time, each lamp costs the Corporation £27 per annum. In Glasgow it is proposed to substitute one arc lamp for every three gas-lamps. In Edinburgh, the public lamps are, on an average, about 30 yards apart. This would make the arc lamps about 90 yards apart. I believe that in some Continental cities the distance is about 55 yards. Let us see what the cost would be by gas. We have, in 90 yards, three lamps, each consuming 2 cubic feet per hour, or 6 cubic feet among them. Burning till midnight, they will be alight for 2072 hours, and will each consume 4144 cubic feet, and at 2s. 10d. per 1000 cubic feet, the charge for public lighting will amount to 11s. 9½d. for each lamp, or £1 15s. 4½d. for the three. If the same amount were spent on gas as is proposed to be laid out upon electric lighting, instead of three lamps, each costing 11s. 9½d., it would provide 34 lamps. A lamp would thus be provided for rather less than every 3 yards of street, which, of course, would be ridiculous. Supposing burners to consume 4 cubic feet of gas per hour were employed, and two lamps were placed between every two existing lamps, we should have fourteen times the light we are at present getting, and the cost for the three lamps would be £8 4s. 5d., or not nearly half the cost of one arc lamp.

Now as to the advantages or disadvantages of the two lights. The advocates of electric lighting claim several advantages for their light. There is a good deal of difference as to what these are; but one on which they all agree is that it does not use up the oxygen in a room, or give off noxious fumes. This is quite true; but do we live under such conditions that we can say

there is a scarcity of oxygen? Certainly not. To be "free as the air" is a common phrase. I wonder if those who recommend electric lighting in that way are ignorant of the fact that a fire in a room will consume twenty times the amount of oxygen that the gas required to light the room will do. They "strain at the gnat" of a gas-jet, and "swallow the camel" of a fire. It is also claimed that the electric light does not blacken ceilings or destroy decorations; but this advantage can also be claimed for gas lighting, where regenerative lamps are used, if the products of combustion are led off.

The question of whether or not the electric light has been a financial success scarcely comes within the scope of this paper; but, as the subject is at present of the first importance for the Corporation of Edinburgh, perhaps I may be allowed to glance at it. Many electric light companies have been started which have not been a success. They have often been the stalking-horse for the promoter and the financier to ride; and, after struggling on for a while, they have, at last, found their way to the liquidator. "The year 1892 has been remarkable chiefly for the large number of working schemes which have been promulgated, and the few which have been carried out." So said the *Electrical Review* on Jan. 6 this year. The extract may be taken to read thus: Promoters are now rather shy; they have not reaped the golden harvest they expected, and those who are interested in the construction of electrical plant do not care to take the risk of starting companies, but prefer to press on corporations to undertake the work themselves. The Liverpool Electric Supply Company have been in existence for more than nine years; they charge 7½d. per unit, and their dividend is 4½ per cent. Their Manager was candid enough to say that electric lighting did not pay them, and that any dividends they declared were earned as electrical engineers in putting in private installations in and around Liverpool. If anyone goes into the subject as I have done, he will come to the same conclusion as I have—that electric lighting is an exotic which requires careful nursing and fostering before it can come to much. No doubt improvements are being constantly made which will cheapen the supply. But the principle cannot be altered; and unless some discovery is made which will bring about a radical change, it can never be very cheap. Improvements are also being made in gas lighting, and when one of them—Mr. Young's new and ingenious method of enriching coal gas by means of paraffin oil—comes into general use, a reduction in price may be expected. And with the more general adoption of the consumption of gas by means of regenerative burners, it will not require to be afraid of any rival system of lighting.

Vapour-Density Methods.—Mr. J. T. Brown, F.C.S., has issued in pamphlet form, a reprint from the report in *Nature*, with extensions, of a paper, entitled "Vapour-Density Methods Historically Treated," read by him at the meeting of the British Association at Sheffield in 1879. It is accompanied by three sheets of diagrams compiled by him, illustrative of past and present apparatus—two, containing 40 diagrams, relating to vapour densities, and the other giving 25 diagrams of temperature regulators.

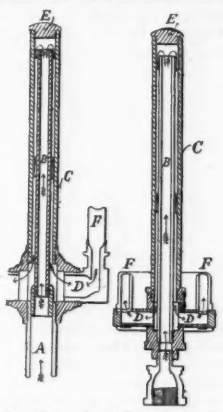
Water-Works in China.—A large dam is in course of construction at Hong Kong, to store a supply of 480 million gallons of water. It will be 750 feet long, 136 feet in maximum height above the foundations, and will hold back an extreme depth of 100 feet of water. The supply is drawn from a well in the middle of the dam, from which the exit-pipe runs at a height of only 12 feet above the bottom of the reservoir. The whole work, according to *Indian Engineering*, is of white and dark blue granite. On the reservoir side, the face is dressed and coursed stone; while the outer face is more roughly dressed and coursed material. The heart is concrete, in which are embedded rough triangular stones set on their pointed ends, about which the concrete is thoroughly consolidated with iron tamping-rods.

The Cost of Compressed Oil Gas for Railway Carriage Lighting.—The *Moniteur du Gaz et de l'Electricité* recently gave some figures as to the cost of producing oil gas for railway carriage lighting. The raw material, consisting principally of Scotch or French schists and Boghead, yields from 50 to 52 cubic metres of gas per 100 kilos.; the illuminating power being three or four times that of ordinary coal gas. At the works at the Paris terminus of the East of France Railway, oil gas, used with a Manchester burner, gives, with a consumption of 22 to 25 litres (0·77 to 0·88 cubic foot) per hour, a light equal to 6·5 candles if not compressed, and to 4·5 candles when compressed to 10 atmospheres. The price of oil in Paris averages 22 frs. 50c. per 100 kilos. For a daily production of 80 cubic metres, the net outlay would be 44 frs. 85c. (the oil costing 33 frs. 75c. delivered), or at the rate of 56c. per cubic metre. In other works, however, where the production is larger, the figure is 37c.; in fact, it appears to range generally from 65c. to 110c. These figures are of interest to those who are engaged in the lighting of railway carriages; for if, by means of high-power burners, a light of 9·5 candles can, as is now claimed, be obtained with 22 litres of compressed oil-gas, the price per Carcel-hour would not exceed 3c. This is an exceedingly low figure—certainly one which the electricians cannot touch with the means at present at their disposal.

REGISTER OF PATENTS.

Regenerative Gas-Lamp.—Holloway, J. E., of Newington, S.E. No. 4206; March 3, 1892.

The patentee says that, to increase the lighting power of ordinary coal gas during its combustion, he proposes to convey it from the usual gas-bracket through a small inner tube, direct into a hollow ball (or other suitable contrivance) attached to the end of a return outer tube. The ball and tube, being affixed in a position to receive the full heating power of the burning gas, become intensely hot; and the gas, having become heated while passing through the hot ball and outer tube, discharges itself into a small boss, whence it is conveyed to the ordinary burners, and is there consumed in the usual manner.



The engraving explains the principle of the invention as applied to ordinary flat-flame burners and the usual Argand pattern.

A is the ordinary gas-inlet; B, the small inner tube, through which the gas is conveyed to the heating chamber E; C, the return outer tube from E, by means of which the gas is conveyed in a highly-heated condition through the inlet to burners of either description. F is in both cases the burner, where the gas is consumed in the usual way.

Gas and Petroleum Engines.—Lanchester, F. W., of Bedford Row, W.C. No. 4374; March 5, 1892.

The object of this invention, relating to gas and petroleum engines, is in part to provide an improved system of governing, applicable for either gas or petroleum engines (but especially adapted for the requirements of the latter); also simplified methods of actuating the exhaust-valve of such engines; also improved petroleum injection and vaporizing arrangements, and means of retaining the walls of the combustion chamber at a temperature uniform and suitable for hot-surface ignition under all conditions of working; and improved means of initially heating the same.

Purifying Coal Gas and Obtaining Products therefrom.—Belton, W., of Shrewsbury, and Davis, G. E. and A. R., of Manchester. No. 6062; March 29, 1892.

This invention relates to a method of washing crude coal gas with a solution of carbonate of soda or of caustic soda (or a mixture of the two, or their equivalents) in such a manner that the impurities—consisting chiefly of carbonic acid, ammonia, sulphuretted hydrogen, and other sulphur compounds—may be removed and readily utilized. Instead of employing water alone in the gas-scrubbers, the patentees propose to use a solution of carbonate of soda or caustic soda, or a mixture of the two or equivalents, of any convenient strength, but preferably of about 10° Twaddel. The liquid employed is brought into contact with the gas; both being reduced to as low a temperature as is practicable, "as the lower the temperature the more easily are the impurities absorbed by the liquid." The operation of arresting the impurities with these solutions can be carried out in any of the washers or scrubbers at present in use where water only is employed; and it is said to be advantageous to arrange the washers or scrubbers in a series of two or more—the solution being used systematically in them, so that, when removed from the earlier scrubbers or washers, it may be saturated as near as may be with the impurities.

The solution charged with impurities from the crude gas can be purified for use over again by heating it with a current of steam (preferentially live steam), or in any other known manner. The carbonic acid, sulphuretted hydrogen, and ammonia are evolved; and the acids of the fixed ammonia combine with the alkali base present in the liquor—the ammonia being liberated in loose combination with carbonic acid. But the liquor is best purified by heating in a sulphate of ammonia still; and the gases issuing therefrom may be passed through diluted sulphuric, nitric, or hydrochloric acid to retain the ammonia, thus separating it from the carbonic acid and sulphuretted hydrogen, the latter of which may be utilized in any known manner.

As this process of arresting the impurities of crude coal gas is a circular one (the purifying agent being used over and over again), it is necessary to keep up and renew the activity of the solution, which is apt to become weakened or exhausted by the gradual accumulation of water in the process, and by the exchange of the acids of the fixed ammonia for the carbonic acid originally combined with the soda. This is done by evaporating the surplus water, and adding from time to time sufficient soda ash or caustic soda to replace that neutralized by the fixed acids of the ammonia. A portion of the residue is cooled for use over again, after cooling in the washers or scrubbers; while another portion is regularly treated for the elimination of the fixed impurities—such as carbolates, hyposulphites, sulphocyanides, sulphocarbonates, and other compounds—by the process of evaporation and fishing.

It has been also found that this may be effected by reserving at intervals a quantity of the liquor running from the still, evaporating

it down to crystallizing strength, and setting aside to crystallize. Fairly pure crystals of carbonate of soda are obtained, which may be then collected and dissolved in water to the proper strength for use over again. The mother liquors from these crystals contain the bulk of the impurities, which may be used for the preparation of carbolates, hyposulphites. sulphocyanides, cyanides, and other salts. If, however, there is but little carbonate of soda remaining in the nearly exhausted liquor, the impurities will either crystallize or be fished out by the foregoing treatment, and the small quantity of carbonate of soda will be found in the mother liquor, which can therefore be used over again.

When it is preferred to employ a mixture of carbonate of soda and caustic soda as the solution for washing the crude coal gas, the solution is to be kept to the proper state of causticity by the addition of quicklime or of hydrate of lime to the solution. This is done preferably by adding the lime to the solution in the form of milk of lime, at a point in the still where all the volatile ammonia has been disengaged, though it would be equally efficacious, but probably not so economical, if the lime were added either previously or subsequently to the stilling operation. The addition of lime to the solution causes a precipitation of carbonate of lime, which must be allowed to settle, and be removed before the solution can be employed again.

Carburettors.—Collet, H., of Finsbury Park, N., and Merichenski, M., of Tottenham. No. 6909; April 11, 1892.

This carburettor is intended either to carburet atmospheric air or to enrich ordinary coal or other gas, so as to increase its illuminating power. The hydrocarbon is supplied from time to time to a reservoir, from which it is automatically fed through a distributor in proportion to the consumption. The air to be carburetted or the gas to be enriched is caused to travel through an extensive channel; and during such travel it mingles with the hydrocarbon vapour and becomes carburetted. The channel is, it is claimed, so devised that its walls are at all times evenly saturated with hydrocarbon, "so that the carburetting action is constantly uniform, and the air or gas is always carburetted or enriched to a uniform degree, without in any way having to depend either upon any regulation of the supply of hydrocarbon or upon any adjustment of the inlet opening for the atmospheric air or gas to be subjected to the action of the apparatus."

Fig. 1.

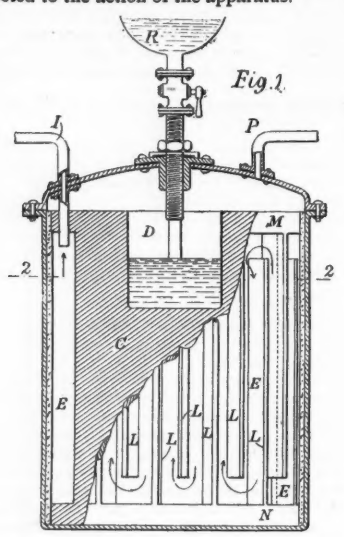


Fig 2.

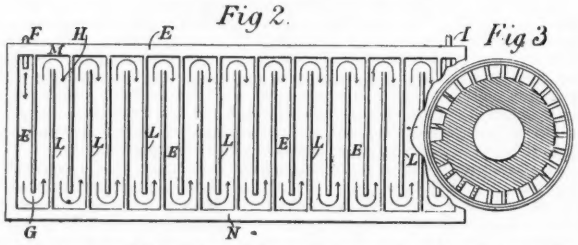


Fig 3

Fig. 1 is a vertical section of the carburettor; fig. 2 shows the hydro carbon distributor as it would be if laid out flat; and fig. 3 is a plan on the line 2 of fig. 1.

The vessel is preferably cylindrical, made of any suitable material, and provided with a gas-tight cover. Into it is placed a body C, which has for its object to distribute the liquid hydrocarbon, and present it evenly to the air, so as to enable it to mingle therewith, and form carburetted air. The distributor has a central chamber D, which contains an almost constant quantity of hydrocarbon. Its outer vertical surface is channelled at E, as shown in fig. 2. This channel begins at the inlet-pipe F for the air to be carburetted or the gas to be enriched; then it descends and passes horizontally at G; then upwards; then horizontally at H; and then continues to follow a similar course until it reaches the outlet-pipe I.

The hydrocarbon contained in the chamber D passes through the distributor (which is made of wood), and oozes out at its external surface, where it is met by the inflowing air circulating through the channel E, and mingles therewith. The hydrocarbon which thus presents itself at the walls of the channel mingles with the air, and is carried away therewith through I, and is replaced by fresh hydrocarbon oozing through the distributor. But any hydrocarbon which oozes through at the outer surface of the vertical ribs L between the channels E, and at the horizontal ribs M N at the top and bottom of the distributor, is taken up by a porous or absorbing jacket, interposed between the outer vessel and the distributor. This jacket may be made of wood, cloth, felt, porcelain, or any other substance capable of absorbing liquid hydrocarbon by capillary attraction. The air to be carburetted, or the gas to be enriched, enters the apparatus through a pipe P in the cover. The supply of liquid hydrocarbon is contained in a closed vessel R, connected at the top to a funnel, and at the bottom to a pipe screwed into a bush, which is secured gas-tight in the cover. It can be adjusted as to height; so that its lower end may be made to dip more or less into the liquid hydrocarbon contained in the chamber D. When once properly adjusted, the pipe is set by a nut.

The action of the apparatus is as follows: Liquid hydrocarbon is supplied into the closed vessel R, from which it descends by gravity into the chamber D, after which, as soon as a vacuum is formed above the liquid in R, the liquid will momentarily cease to flow, until one or more bubbles of air rise from the chamber into the vessel. The liquid will then again commence to flow downward, and so on until the chamber D gets filled up to a level reaching somewhat above the bottom end of the feed-pipe. The hydrocarbon supplied to the chamber will gradually travel in all directions through the pores of the distributor C, till it reaches the compound channel E at its outer surface. As soon as the hydrocarbon descends below the almost constant level at or near the bottom end of the feed-pipe, it is replaced by fresh hydrocarbon from above, and so on as long as the vessel is kept supplied.

The cock of the inlet-pipe P is then opened, and atmospheric air or gas is introduced into the apparatus; the air or gas finding its way through the pipe F into the compound channel E, and becoming saturated with hydrocarbon vapour as it travels through the channel. During such passage, the air is not only saturated with the hydrocarbon vapour which evolves at the three outer walls of each vertical channel E of the distributor, but also with the hydrocarbon which has been absorbed by, and evolves as vapour at, the inner wall of the absorbing jacket. The carburetted air or enriched gas issues from the apparatus through the pipe I, and is conveyed away for use.

Gas-Engines.—Pollock, G., of Glasgow. No. 8401; May 4, 1892.

This invention has reference to the construction and fitting of the governor or trip-mechanism which regulates the action of the inlet gas-valve of gas-engines, with the object of giving "more exact and better action of this mechanism than heretofore."

The improvements apply to that form of trip or governing mechanism which has a valve pressed to admit gas by opening inwards against the action of a light spring, which keeps the valve always closed when not pressed in, and is pushed inwards by the action of the angled point of a reciprocating tappet lever fulcrumed on one end of a beam or other equivalent lever actuated by a cam, and anti-friction pulley to push this lever inwards against the power of a spring—always keeping the tappet lever out of action, except when pushed in by the cam, which is mounted on a shaft geared to rotate once for each double stroke of the engine. The free end of this tappet lever reciprocates on an inclined rest in front of the spindle of the valve, which is so notched and angled on its top surface that, when the tappet lever reaches the top or apex of its inclined guide rest, and the engine is working at its full power, and the cam rotating at the desired minimum velocity, the tappet always takes into the notch on the valve-spindle, and presses it inwards to open the gas-valve at each instroke of the piston. It is, however, so adjusted that, whenever the engine and cam-shaft rotates at a few revolutions above its normal velocity, the tappet lever comes forward at such a velocity over the apex of its angled guide, that it misses the valve-spindle, and allows the engine to go away without the admission of gas for one or more strokes, until the engine is reduced to its proper speed. The adjustment of the apex of this guide part requires great care in construction; and the present improvements consist in mounting the angled rest in a vertical slide guide on a bracket beneath, and in front of, the valve-spindle, with a thumb-screw spindle or other equivalent (such as a wedge), which will raise and lower the inclined guide on which the tappet rests, in order to adjust it to the finest increments in height, and thus suit the velocity desired of the engine.

Water-Meters.—Thomson, J., of Brooklyn. No. 9878; May 24, 1892.

This is an invention in water-meters, comprising (according to the patentee) "a complete positive system adapted both to the direct and to the proportionate measurement of fluids moving under pressure." To accomplish the inferential measurement of water, it is, of course, necessary that the ratio of the measured volume to that of the unmeasured volume shall be constant under different rates of flow and variable conditions of friction. Hence, as the inventor remarks, "a primary measuring device is a necessary component of such apparatus; and while it is true, in the abstract, that almost any type of measuring mechanism might be employed, yet the fact is that much depends upon the proper selection, design, and construction of this element of a proportional meter." He then proceeds to take up the first general division of the subject—viz., the measuring and recording mechanism, which is of the well-known disc-action.

The first improvement is in the manner of making the flange-joints and of disposing the water-channels, so as to avoid enclosing the disc-chamber casing, within separate pressure-resisting casings. The second improvement relates to the manner of conveying the flow to the disc-chamber, in order to economize space and material (which features are more or less contingent upon the manner of jointing the casings). The third improvement relates to the construction of the casing to form the disc-chamber; and it consists in producing the spherical contour of the chamber in the main casings, terminating in shallow cylindrical bearings, having stops or shoulders. The fourth improvement refers to the control of the disc. The fifth improvement is in the reducing gear train, which improvement consists in forming hubs upon the intermediate pinion; in adapting these hubs to the grooves or recesses formed in the fixed and free differential gears; in attaching the free gear directly to the stuffing-box spindle; and in securing the fixed gear directly to a bearing formed in the upper disc

casing. The sixth improvement consists in the design of the ball and disc, whereby they may be made of hard rubber, moulded together as one part with sufficient accuracy not to require additional finishing. The seventh improvement is in forming shallow grooves in the ball and also in the periphery of the disc, the object of which is to provide clearance spaces wherein particles of sand (or other foreign material liable to be forced between the bearing surfaces) may enter these spaces, and eventually work their way out, instead of being retained to cut and wear the bearings. The eighth improvement relates to the dial and pointers of the register.

The second general division of the subject refers to the method and means for controlling the proportional flow, and the relation thereof to the measuring mechanism. This portion of the apparatus is positively operated by the differences of pressure between a plurality of chambers, one of which (the controlling chamber) receives the discharge from the measuring mechanism. The result desired to be accomplished is to cause a positive increase of resistance to the entire flow to follow any decrease of pressure in the controlling chamber, and *vice versâ*, upon an increase of pressure therein. Then, furthermore, means and conditions are provided whereby the proper operation of the device as a whole shall not be liable to disturbance in its proper function by changes in the velocity of flow.

Meters for Liquids, Vapours, and Gases.—Tobey, H. A., and Yaryan, H. T., of Toledo, Ohio, U.S.A. No. 23,182; Dec. 16, 1892.

This invention, relating to dry meters, has for its object the construction of a device for measuring liquids, vapours, and gases, which shall be "simple in construction, cheap, light, compact, durable, positive in operation, noiseless, causing no pulsation by its valve movement, and reducing friction to a minimum." The further objects of the invention are: First, to provide such meter with ports of peculiar form and arrangement, and with a rotary slide-valve actuated by the pressure of the liquid to be measured, so that the induction and eduction ports shall present substantially a uniform and unvarying area of opening, and thereby prevent pulsation; second, to provide a central crank-shaft, actuated by the movement of a plurality of diaphragms, and adapted to give motion to the rotary slide-valve above referred to, and to the registering mechanism of the meter; third, to provide a valve and valve-seat in which the perfect contact of the surfaces shall be preserved by the uniform wear of the parts; and fourth, to dispense with the stuffing-box heretofore in use, and to furnish a joint between the meter and the registering device which shall overcome friction, wear and leakage, and which shall be durable, practically noiseless, and absolutely gas-tight.

APPLICATIONS FOR LETTERS PATENT.

5873.—Clinch-Jones, F. J., "The Clinch-Jones gas-furnace." March 20.

5920.—Beale, F., and Ennis, T. F., "Charging gas-retorts." March 20.

5951.—Fitzgerald, J. H., "Gas washers and scrubbers." March 20.

6014.—Wallace, J. A., "Incandescent gas-burner." March 21.

6049.—Westinghouse, G., jun., and Ruud, E., "Water-meters." March 21.

6051.—Velna, G. de, "Manufacture of illuminating gas, artificial fuel blocks, and coke for metallurgical purposes." March 21.

6079.—Parkinson, W. C., "Gas grillers or grilling-stoves." March 22.

6086.—Anderson, J., "Coin-freed gas-meters." March 22.

6093.—Bellamy, A. R., "Gas and similar motor engines." March 22.

6142.—Richie, W. F., "Manufacturing gas." A communication from J. B. Archer. March 22.

6162.—Pintsch, J., "Incandescent gas-burners." March 22.

6221.—Wade, A., "Cocks, more especially gas-cocks, or adjuncts thereto." March 23.

6243.—Mills, C. K., "Joint for steam, water, gas, and other liquids or fluids." A communication from A. Costadau. March 23.

6324.—Glasgow, A. G., "Manufacture of water gas." March 24.

6408.—Jones, J. F., "Cooling or heating air or other gases." March 25.

The New Water Scheme for Skipton.—Some eighteen months ago, when the Skipton Local Board were endeavouring to carry out a scheme of water supply which would cost about £40,000, at High Skibeden, their project was rejected by the ratepayers. Shortly after this, the Ratepayers' Protection Association sent an Engineer (Mr. Landless) to a meeting of the Board, advocating and recommending the purchase of the Eastby Mill estate as a source of additional supply. At the time, the report of the Engineer was not accepted by the Board; but a few weeks ago, negotiations were carried out by them for the purchase of the Eastby site and water rights.

Gravitation Water Scheme for Carlisle.—The Water Committee of the Carlisle Town Council held a meeting on the 22nd ult., at which they had under consideration a report made by Mr. J. Mansergh upon the proposal to supply the city with water by gravitation from Skiddaw. The report is a very voluminous document. It goes fully into the whole question, and sets forth a complete scheme of water supply by gravitation, with a large reservoir in Mosedale for compensation and other purposes, and a filter-bed at Durdar. He estimates the cost of the whole at £210,000. The general feeling of the Committee, after examining the report, was that Mr. Mansergh's scheme was a good deal more extensive and costly than they had contemplated; but they were of opinion that some of its most expensive features—such as the reservoir at Mosedale and perhaps the filter-beds at Durdar, might be considerably modified and curtailed, without impairing the general efficiency of the project. It was resolved, therefore, to report to the next Council meeting that the scheme is still under consideration. In the meantime Mr. J. Hepworth, the Gas and Water Engineer, will continue his researches upon various points involved, especially as to the variation and extent of the supply in the Caldew at the early part of its course, and as to whether it may not be possible to make various reductions in the works contemplated in Mr. Mansergh's scheme.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress was made with Bills down to the adjournment for Easter, on the 28th ult.:—

Bills read the third time and passed: Accrington Gas and Water Bill; Dublin Corporation Bill; Staines and Egham District Gas Bill.

Bill Royal Assented: Imperial Continental Gas Association Bill.

HOUSE OF COMMONS.

The following further progress was made with Bills down to the adjournment for Easter, on the 30th ult.:—

Further Standing Orders complied with: Bodmin Water Bill.

Bills read the first time, and referred to the Examiners: Accrington Gas and Water Bill; Dublin Corporation Bill; Electric Lighting Provisional Order Bills (No. 1, relating to Partick; and No. 2, to Beckenham, Colchester, Eccles, and Newcastle-upon-Tyne); Staines and Egham District Gas Bill; Wolverhampton Gas Bill.

Bills read a second time and committed: Rathmines and Rathgar Water and Improvement Bill; Sheffield Corporation Water Bill; Stockton-on-Tees Corporation Gas Bill.

Bills reported: Brighton and Hove Gas Bill; Plymouth Corporation Water Bill; Stirling Water Bill.

Bills read the third time and passed: Altrincham Gas; West Hampshire Water Bill.

A petition against the London County Council (General Powers) Bill was presented from the South Metropolitan Gas Company.

The East London Water Company have presented a petition for a Bill to confer power with respect to certain Lammas lands at Leyton, included in the Bill recently rejected on the motion for second reading.

HOUSE OF COMMONS COMMITTEE.

(*Before Mr.* H. J. Roby, *Chairman; Sir* G. Chesney, *Sir* J. Kitson, *and Mr.* Mildmay.)

Tuesday, March 14.

BARRY AND CADOXTON LOCAL BOARD BILL.

This Bill—which is to enable the Barry and Cadoxton Local Board to acquire the undertaking of the Gas and Water Company—came before the above-named Committee to-day.

Mr. Pembroke Stephens, Q.C., and Mr. Claude Baggallay appeared for the promoters; Mr. Cripps, Q.C., and Mr. Robson, Q.C., represented the Company, who opposed.

Mr. Pembroke Stephens, in opening the case, explained that the Barry district was one which had sprung up comparatively recently. By the census of 1881 the population was 496; the place being then a mere village on the sea-shore. In 1891, however, it had risen to 12,671; and in the present year it was estimated at considerably over 14,000. In 1886 the rateable value amounted to £2220; the next year it had grown to £10,949; in 1888, to £15,400; in 1889, to £17,600; in 1890, to £33,900; in 1891, to £114,400; in 1892, to £127,000; and in the present year, as nearly as could be made out, to £132,000. So that, whether they took the population or the rateable value, the growth of the district had been excellent. The increase in the number of houses told the same story. In 1884 there were only 80 houses in the district; last year, 2500; and this year it was calculated that there were about 3400. Under whatever head considered, the rise was simply unprecedented. In recent years the opinion had sprung up, and had been more and more accepted by the public, that the management of certain matters, such as water supply, should be taken out of private hands and entrusted to local authorities. The Local Board for Barry and Cadoxton was formed in 1888; but before that year—in fact, in 1884—the Barry Dock Company had obtained an Act authorizing them to execute certain works in the disttict. Very soon afterwards—viz., in 1886—the Gas and Water Company was formed, and procured an Act for both gas and water purposes. In 1889 the Company went to Parliament for new and different powers; and in the Bill then promoted they inserted a clause—a voluntary, not a compulsory clause—enabling them to sell, and the Local Board to buy, their undertaking on terms, and distinctly recognizing the principle of purchase. The Local Board were not at that time in a position to entertain the matter, and they petitioned against the Bill. Under the Act of 1886, the Company were authorized to raise £36,000 of share capital and £9000 on loan. By the Act of 1889, they were empowered to raise £32,000 o share capital, and were granted borrowing powers to the extent of £8000; making in all a share and loan capital of £85,000. In 1891 the Company seemed to have considered that they were getting near the end of their resources; and last year they introduced a Bill to enable them to extend their operations. The reason for this, as given by the Directors in their report, was that the business was increasing, and that they were extending their mains to Cadoxton and other portions of the district—enabling them to supply new houses with gas and water, and to make better provision for the public lighting. When the Company were promoting their last Bill, a considerable amount of correspondence took place between the Local Board and the Solicitors and officials of the Company. The former seemed to have recognized the existence of the desire to, and the possibility of, purchase; but the latter acted in a very prevaricating way. In reply to a letter from the Solicitors, the Clerk to the Local Board wrote that the Parliamentary Committee of the Board would be prepared to recommend them to apply for the insertion of a clause giving power to purchase the whole undertaking by arbitration—the Board paying the cost. On Feb. 10, 1892, the Engineer of the Company wrote regretting that they could not accede to the wish of the Board, because the Bill had been deposited. This was really no difficulty, because the Board had offered to defray the entire cost of the proceedings before the Standing Orders

Committee. Then followed a letter on behalf of the Company, asking how the Board justified their departure from a resolution arrived at in 1888. There was no suggestion that there was anything harsh or unusual in the Board being prepared to take over the undertaking in 1892 and not in 1888, because in the latter year the main drainage system was incomplete. The Board then summoned a meeting of ratepayers, who cordially approved of the action taken by them. The Company were manufacturing gas on lands which they were prohibited from using by their Act of 1886, and they were liable to an injunction for so doing; and the Company were also in default as regarded the separate accounts they were required to keep for the gas and water businesses. In conclusion, the learned Counsel argued that, if ever there was an undertaking ready for transfer, according to all ordinary precedents, that of the Company was.

The following evidence was then given in support of the Bill:—

Mr. *J. C. Meggitt* said he had been a member of the Local Board since its formation. During the last ten years, Barry had developed into an exceedingly active commercial place. It had, however, suffered severely from an inadequate supply of water. In 1887, there was something like a water panic; and considerable extensions were required in the interests of the town, which the Board would be prepared to undertake. Since the present Bill had been introduced, the inhabitants of the locality had petitioned in its favour.

In cross-examination, witness said that in their earliest stages the Company had great difficulty with their system; and he remembered that 1887 was one of the driest years within living memory. Up to 1889 they were in difficulties with regard to their sources of supply. It was a hilly district; and the roads were not very good. But, notwithstanding these and many other difficulties, the Local Board thought the requirements of the district would increase, and that the Company would turn out well. At present the rates at Barry were 1s. 6d. in the pound; and there was an indebtedness of something like £50,000. He did not hear it stated at the meeting of ratepayers that if the Board acquired the gas and water works the rate would go up to 5s. in the pound. The Company had agreed to the purchase of their undertaking by agreement.

Mr. *G. Thomas*, an architect and surveyor at Cardiff, said he was a member of the Barry and Cadoxton Local Board, and Chairman of the Public Works Committee of that body. He had long known the district of Barry, and had noticed its surprising development. At the present time the Company were not supplying either gas or water on the edges of the Board's area. There was a considerable feeling of apprehension in the district of a recurrence of the dearth of water of 1887; and there was a very strong feeling in favour of the Board possessing the powers of supply. It was felt that it was a question of now or never; because if the Company obtained increased borrowing powers, the purchase price would go up to beyond what the Board could give. It was felt that the undertaking could be bought cheaper now than when it had been developed; but this was not the reason the Board asked for unique powers. Their application was based on public policy.

Major-General *Lee* said he was a member of the Local Board, and most thoroughly concurred in all that had been said by previous witnesses with regard to the gas and water undertaking. The only difference between the Company and the Board was that the former desired a clause enabling them to sell, and the latter required a clause desiring them to sell.

Mr. *J. C. Pardoe*, Surveyor to the Board, said that portions of the Company's works had been constructed on lands unauthorized for the purpose. He agreed generally with the evidence of the previous witnesses.

Wednesday, March 15.

Mr. *Pardoe*, in further examination, said the area of the works on authorized land was 2 acres 2 roods 39 perches; and the area of those on unauthorized land, 2 acres 2 roods 14 perches. So that, after making allowance for the limits of deviation, one-half of the site of the works was on unauthorized land. He had compared the prices of gas in the Barry and Cadoxton district with those charged in other districts where the circumstances were fairly similar. In Barry, 4s. 2d. per 1000 cubic feet was charged, with a discount for prompt payment; in Newport, 3s. 2d.; in Abergavenny, 3s. 2d.; in Cardiff, Bridgwater (Somersetshire), and Penarth, 3s.; in Neath, 3s. 4d.; in Merthyr, 3s. 8d. to the private customer, and 3s. 2d. to the Local Authority; and in Aberdare, 4s. to the Local Board, and 4s. 3d. to the private consumers. He had heard complaints as to the quality of the gas; but each time he had tested it he had found it to be above the authorized standard.

In reply to Mr. CRIPPS, witness admitted that at a number of other places, fairly comparable with the local conditions of Barry, the prices charged were higher than in that town.

Mr. *H. Snell*, M.Inst.C.E., said he lived at Penarth, and was Surveyor to Lord Windsor's estate. He had made a survey of the works of the Company, and verified Mr. Pardoe's plans. He found that half the works were constructed on unauthorized lands.

Mr. *J. A. Hughes*, Clerk to the Local Board, produced the correspondence between them and the Solicitors to the Company.

Mr. *H. Rofe*, M.Inst.C.E., was the next witness. Speaking from the accounts of the Company as to the expenditure after the Act of 1889 was obtained, he said that at the end of 1892 they had laid out £49,961 in regard to water, or about £6900 beyond their authorized capital; and with regard to water and gas, they had spent some £96,000, or £11,000 beyond the total authorized capital of £85,000. Therefore they had not a shilling wherewith to supply the town, but their capital was considerably overspent. They were not in Parliament this year either to remedy the over-expenditure or to ask for more money, though they themselves estimated that they would require £2000 a year for ordinary extensions. The Company had not been in the habit, until 1892, of keeping separate gas and water accounts, as their Act required them to do. Witness spoke at some length as to other irregularities in the accounts.

Mr. CRIPPS then opened the case for the opponents of the Bill. What, he asked, were the suggestions made by the promoters, and what were the reasons urged why in this case a special line should be taken in the way of compulsory purchase by the Local Board? There was an allegation that the Company wanted money; in fact, the position was exactly the opposite. Such was their strength, such was their credit, that they had been able to carry out their obligations, as regarded both gas and water, without any serious complaint up to the present time; and at present there was no necessity for any further capital expenditure beyond the resources of the Company. According to Mr. Rofe's evidence with respect to water, they had sufficient for four or five years; but his (Mr. Cripps's) evidence would show that they had sufficient for a much longer term. The Company had done their duty in all respects hitherto; and there was not a tittle of evidence or a suggestion that they could not do the same in the future.

The following evidence was then given on behalf of the opponents:—

Mr. *J. A. B. Williams*, M.Inst.C.E., the Chief Water Engineer to the Corporation of Cardiff, said that he was Consulting Engineer to the Barry and Cadoxton Gas and Water Company. After very extended examination, he chose the present sources of supply for the Company. They were adequate for the purposes of the existing population of the district; and even for an addition of 60 or 70 per cent. The daily consumption was now 17 gallons per head; but there was a great deal of waste, which he hoped to prevent in the future. In Cardiff the consumption was at the rate of 23 gallons per head per day; but from this should be deducted 8 gallons for trade, as distinct from domestic and sanitary purposes. At Penarth, a suburb of Cardiff, the consumption was at the rate of a little more than 14 gallons per head per day; and he thought that at Barry it should, and could reasonably, be reduced to 15 gallons. The permanent works of the Company were very substantial, and had been designed with every regard for efficiency and economy. He had never heard it suggested outside the Committee-room that there was a doubt as to the capacity of the Company, either financially or with regard to the water supply, to fully meet the requirements of the district now and for some time to come. In 1888, when the Company had spent about £3000 only, they offered to hand over the whole concern, with all its rights and privileges, for something like cost price; and he thought it was most unfair that the Company should be called upon compulsorily to part with their undertaking now that it was on the eve of realizing their anticipations.

Thursday, March 16.

On the re-assembling of the Committee this morning,

Mr. PEMBROKE STEPHENS said: I am able to state, with the concurrence of Mr. Cripps, that since we met last evening, the Local Board and the Company have considered the matter very carefully, I am happy to say the Company have met our views; and we have, as far as we reasonably could, I think, fairly and fully met them. The result is that an arrangement has been made which will be submitted to the Committee in due course, and which will relieve them of any further trouble in deciding the case. The matter having been settled in this way, some little time must necessarily be taken for the purpose of getting the particulars into a satisfactory shape, and having the agreement before you. It is right I should say there is a question—not in contest between us in any way, but having an important bearing on the town as regards the actual terms on which the money shall be provided for the purpose of the purchase. In the exceptional circumstances of the Barry district, it is common knowledge on both sides that in recent years (or the early years in the history of the Local Board), the Board have had to incur great cost in the district in doing the work incumbent upon them. We are desirous—in fact, it is absolutely necessary, in the circumstances of the town and district—that we should have the most favourable terms Parliament is entitled to give us in its discretion. We shall not ask for anything extreme or unusual; but, as this is a wholly exceptional case, we think we should get exceptional terms.

The CHAIRMAN expressed the pleasure of the Committee at hearing the parties had come to an agreement, and said he only wished they had done so two days before.

The terms on which the transfer will take place are the payment by the Local Board to the Company of £152,000—debentures to the amount of £17,000 to remain; making a total of £169,000.

On the following Tuesday, the Bill was reported to the House; and the Committee's report has since been printed. It sets forth that the Bill does not give borrowing powers for any purposes for which such powers already exist or may be obtained under General Acts, without subjecting the exercise of the powers under the Bill to approval from time to time by the proper Government department. The purposes for which the loans are authorized are given in an appendix. The amount required for defraying the expense of obtaining the Act is to be repaid within ten years; that needed for the purchase of the gas-works, within forty years; that for the water-works, within fifty years. The working capital, &c., will be sanctioned, as usual, by the Local Government Board. The Committee, when considering the Bill, had before them a report thereon from that Board; and in another appendix is shown the manner in which their recommendations were dealt with. The Local Board are to keep separate accounts of the gas and water undertakings.

The Electric Lighting Question at Brighton.—The result of the inquiry conducted at Brighton a few weeks ago by Mr. Ingram B. Walker and Major Cardew, R.E., into the application of the Brighton Electric Lighting Company to the Board of Trade for a Provisional Order to enable them to supply electricity within the borough (see *ante*, p. 511), has been the refusal of the Board to give the further powers sought. The Company, it will be remembered, were opposed by the Corporation, who are also suppliers of electricity. In their report, the Inspector said that, while they were of opinion that the Company had some claims upon the consideration of the Corporation, they could not recommend the Board of Trade to dispense with the consent of that body. They thought the allegation that the Corporation would be unable to afford a satisfactory supply was not proved; and they stated that the suggestion that the Local Authority would not be able to conduct their operations at a profit was "a matter for the decision of the ratepayers." Our readers are aware that the Company have now a Bill before Parliament to obtain further powers.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Saturday, March 25.

(*Before Mr. Justice* NORTH.)

Guardians of Hunslet Union v. Ingram.

In this case, the defendant, the Hon. Mrs. Ingram, had been supplying water to the inhabitants of the townships of Temple Newsam and Halton—places within the jurisdiction of the plaintiffs—ever since the year 1882, when an arrangement was come to between them and an agent for Mrs. Ingram that she should supply water to the rest of the inhabitants on the same terms as she supplied her own tenants. The present application was a motion for an interlocutory injunction till the trial of the action to restrain her from ceasing to supply the inhabitants with water on the terms on which she had hitherto done this. At the time the arrangement was entered into, Mrs. Ingram had reservoirs and plant for the supply of her own tenants. She made the necessary extensions and expenditure to serve the rest of the district to which the agreement related, and began and continued to supply water to all the inhabitants down to the present time. In consequence of a report by the Medical Officer of Health for the district for the year 1890, the Local Government Board made inquiries of the Guardians as to what steps they proposed to take to meet certain risks of pollution reported by him. This led to their negotiating with Mrs. Ingram for the purchase of her water supply and works, and subsequently to their negotiating with the Corporation of Leeds for obtaining water from them. On Dec. 21 last year, the Solicitor of Mrs. Ingram served notice on the consumers of water in the two villages supplied by her other than her own tenants that she would cease to serve them after March 25, 1893. The result was that the writ was issued, and the present motion was made.

Mr. COZENS HARDY, Q.C., and Mr. SWINFEN EADY appeared for the plaintiffs; Mr. S. HALL, Q.C., and Mr. WARRINGTON represented the defendant.

Justice NORTH held that there was a binding agreement on Mrs. Ingram (which the Guardians were the proper persons to enforce) to supply the inhabitants on the same terms as she supplied her own tenants; that this was an agreement to which she could not put an end without giving reasonable notice; that what "reasonable notice" to determine an agreement to supply an article was, was a question that depended on the nature of the article to be supplied and the circumstances of the case. It might be reasonable to give very short notice to cease to sell coal—an article which could be at once bought elsewhere; but the supply of water was the supply of an article of first necessity. The evidence showed in this case that water could not be obtained from wells in the district, and that it would be necessary to go to a distance to procure a proper supply; and he did not consider the notice Mrs. Ingram had given was reasonable. He should therefore grant an injunction till the trial, restraining her from discontinuing the supply.

COUNTY OF LONDON ASSESSMENT SESSIONS.

Clerkenwell, Tuesday, March 28.

(*Before Sir* P. H. EDLIN, Q.C., *Chairman and a Bench of Magistrates.*)

The Gaslight and Coke Company's Assessment Appeals.

To-day two appeals against the assessments of The Gaslight and Coke Company's pipes and mains in the two parishes of the Hackney Union, appearing in the supplemental lists made in 1892, were decided. In 1891, the Company, it will be remembered, entered upwards of 120 appeals against the quinquennial lists for different parishes in the Metropolis, including the two now in question. These were heard in 1891 and 1892—the proceedings being fully reported in Vols. LVIII. and LIX. of the JOURNAL; and in both the parishes in the Hackney Union reductions were granted. In the supplemental lists that were now appealed against, the assessments fixed by the Court in 1892 had been increased from £18,664 to £21,608, and from £3283 to £3839.

Mr. LITTLER, Q.C., and Mr. DANCKWERTS appeared for the appellants; and Mr. BALFOUR BROWNE, Q.C., and Mr. WALTER C. RYDE for the respondents.

The appellants contended that there had been no such alteration since the decision of the Court as to warrant any increase in the assessment. The respondents argued that the alterations in the price of gas from 2s. 6d. to 2s. 9d., and again to 3s. 1d. per 1000 cubic feet, coupled with a diminution in the cost of production, was sufficient evidence. The Court held that no substantial alteration in rateable value had been shown since the former decision, and that all the facts now relied upon might well have been foreseen and taken into account when that decision was given. The appeals were accordingly allowed, with costs; the increased assessments being in both cases erased from the supplemental list.

A Water Company for Blandford.—The preliminary steps to forming a Water-Works Company in Blandford, Dorset, were taken on the 20th ult., when a strong Board of Directors, consisting of some of the leading ratepayers and owners, was formed. The capital will be £12,000. Mr. C. E. Porter, an auctioneer in the town, has been appointed Secretary of the Company.

British Gaslight Company, Limited.—The ordinary general meeting of this Company was held last Wednesday (Mr. J. Horsley Palmer in the chair), when the report of the Directors and the accounts for the half year ending Dec. 31 last were submitted and adopted. The operations of the Company were reported to have been satisfactory. A dividend at the rate of 20s. per share for the half year was declared, with a bonus of 2s. 6d. per share. The thanks of the meeting were accorded to the Chairman and Directors, and also to the Secretary (Mr. F. Lane Linging) and officers of the Company.

MISCELLANEOUS NEWS.

SHEFFIELD GAS PROVISIONAL ORDER.

At a Special Meeting of the Sheffield City Council last Wednesday the Town Clerk read a letter (bearing the above heading) from Sir Courtenay Boyle, of the Board of Trade. It ran as follows: "With reference to the objections of the Corporation of Sheffield to the above-named Order, and to the interview which took place at this office on the 17th inst., I am directed by the Board of Trade to inform you that, after careful consideration of all the circumstances, they have come to the conclusion that it would not be proper for them to insert a clause in the Order to the effect desired by the Corporation—viz., that the Sheffield United Gas Company should not be permitted to raise the new debenture stock, proposed to be authorized by the Order, except upon the condition that the Company should be under an obligation not to call up their uncalled-up capital until they have exhausted any borrowing powers that may be given by the Order, unless meanwhile they are able to pay 10 per cent. upon such uncalled capital without increasing the price of gas. The Board of Trade are of opinion that it would not be fair so far to interfere with the conditions under which authorized capital of the Company has already been issued and subscribed." The Town Clerk added that he attended, and met the representatives of the Gas Company; and the Board of Trade seemed impressed with the reasonableness of the Corporation's request. He thought they would have decided in favour of the Corporation, except in regard to the legal point (which was very difficult to get over) that the Corporation were asking the Company to do something which interfered with their statutory rights. This point had apparently been too much for the Board of Trade; and it appeared they had no power to do what the Corporation desired them to do. Alderman Clegg moved that the letter be entered on the minutes; and this was seconded by the Mayor (Alderman Langley). Mr. Styring moved, as an amendment, that the matter should be referred back to the Parliamentary Powers Committee. He observed that this action of the Board of Trade did not preclude the Council taking other steps; and it was possible, on further consideration, that the Committee might be of opinion that the Council should proceed further. The amendment having been seconded, was carried by eleven votes to ten.

BURY CORPORATION GAS SUPPLY.

The Railway Siding for the Gas-Works.

On Thursday, the 23rd ult., Colonel J. O. Hasted, R.E., held an inquiry at Bury respecting an application made by the Corporation to the Local Government Board for powers to borrow several sums of money, including an amount required to complete the railway siding to the gas-works. The Town Clerk (Mr. J. Haslam) explained that, by the Bury Gas Act of 1890, powers were obtained to construct a short connecting line between the Lancashire and Yorkshire Railway and the gas-works. It was a very short line—a little over half a mile in length; and the reasons for its construction were briefly that it would offer greater facilities for obtaining raw material and for conveying away the bye-products. Another consideration was that Elton was practically devoid of any railway accommodation for its mineral traffic; and it was thought that the railway would materially assist the industries of that part of the town. The main road to the gas-works was through a congested part of the borough; and if the carting were taken off the streets, it would relieve that locality from the heavy traffic of many thousand tons, and be a great saving to the Health Department by helping to keep the streets cleaner. The parliamentary estimate for the construction of the line amounted to £21,293. At that time the sum of £25,000 which was authorized to be borrowed for the construction of the line was thought to be ample; but, unfortunately, in the construction, the Borough Engineer had from time to time met with considerable difficulty. Mr. J. Cartwright, the Borough Engineer, then gave evidence. He said he was the Engineer for the siding, and made the parliamentary survey and designed the work. The main necessity for the siding was the loss in carting materials to and from the gas-works; and it was also to provide for the mineral traffic of Elton and district. Besides being a relief to a congested district, it was believed that there would be a considerable profit. Under the heading of earthwork, the original expenditure was £2294; but the amount was now £3373. The difference was accounted for by the extra depth of foundations. The parliamentary estimate for the excavation was 1s. 9d. per yard; whereas the contract price was 2s. For bridges and public roads, the estimate was £1733; the actual cost, £2599. Adding the percentage, it made a difference of £692. More than £3000 had been expended on the siding which was not included in the original estimate, which was £16,041, with an additional £1604 for contingencies at the rate of 10 per cent.; making a total sum of £17,646. To this they must add £3647; making a total estimated cost of £21,293 for works apart from the land. The actual cost was £28,464. The works not included in the parliamentary estimate, but carried out since were: Public siding, £3012; engine-house and weighing-machine, £400; additional land and buildings, £1353. The total amount not included in the original estimate was £5805, which brought up the cost of constructing the line to £37,916. If they deducted the £25,000 authorized by the Act to be borrowed, it left a balance of £12,916, which they actually wanted for the works. They proposed to borrow £15,000 in round numbers. Mr. Cartwright then produced plans and explained them in detail. He said that, even taking the extra expenditure into consideration, he was of opinion the railway would be a financial success, and would be a great saving to the Gas Committee, especially now that the public siding was made. It would be not only a further source of gain to the Committee, but also to the manufacturers in the district. The inquiry then closed.

South-West Suburban Water Company, Limited.—This Company has been registered with a capital of £60,000, in £10 shares, to carry into effect an agreement made with the South-West Suburban Water Company to construct water-works "within or outside the limit of the United Kingdom," and to supply water therefrom.

JOHANNESBURG LIGHTING COMPANY, LIMITED.

Reports by the Directors and the Managing-Director.

At the Meeting of the Shareholders of the above Company next Thursday, the Directors will present their first report, accompanied by the accounts for the period from the date of the incorporation of the Company (Nov. 20, 1891) to Dec. 31, 1892, and by a report from Mr. W. F. Lance, the Managing-Director in Johannesburg. As the last-named document deals at some length with the position of the undertaking, we will take it first.

On Mr. Lance's arrival in South Africa, at the end of 1891, his first object was to arrange for the incorporation of the Company in Johannesburg, and the completion of the legal transfer of the concessions and all other assets from the old Company. He then took formal delivery of the works, plant, and moveable assets. The works were approaching the stage at which gas manufacture could have been commenced; and it became necessary for him to effect their completion, and lay a certain quantity of pipes for distribution. The only electric plant then erected was that for the ten arc lights which had been placed in the streets in accordance with the Government stipulation, pending their lighting by gas. Further immediate requirements for electric lighting were, however, so pressing, that he immediately entered into a contract with Messrs. Woodhouse and Rawson to supply plant for 1200 8-candle incandescent lights; and a commencement of lighting by this system was made on April 24, 1892, with the Rand Club—other buildings being subsequently added. During the completion of transfer of the concessions, questions were raised by the Government as to the Company's contract with them for street lighting by gas; and it became advisable to enter into negotiations with them on various points. The result was the conclusion of an agreement under which both concessions were extended from 50 years to 99 years, a title was given to the 8 acres of land held by the Company, certain objectionable provisions of the concessions were removed or modified, an extension of time was obtained within which to supply the town with gas and electric light, and generally the position of the Company was materially strengthened. In consideration of these advantages, the claim to a contract with the Government for street lighting was waived; and the Company undertook to supply, free of charge, gas for 100 gas-lamps, consuming 5 cubic feet per hour, in the streets. On the lighting of these lamps, the electric arc lights then running were to be discontinued, unless paid for by the town; and the cost of erection of the 100 gas-lamps was to be defrayed by the Government. Gas was first lit in the streets of Johannesburg on June 20, 1892; the coal used in the manufacture being Transvaal, from Olifant's River, about 70 miles distant, whence it had to be conveyed by bullock-waggons. Gas-mains have subsequently been extended to meet requirements as far as possible; and they now reach a total length of about six miles. This, however, represents only a comparatively small portion of the town; the suburbs being as yet untouched. The consumption of gas in private premises was at first greatly retarded for want of suitable fittings (a proper stock of which was not available until about November last year), as well as by the high rate of 20s. per 1000 cubic feet, which was at first fixed for gas. After that month, the tariff was reduced to 15s.; and the consumption accordingly commenced to increase—that for December (a mid-summer month) being 250,000 cubic feet. In connection with the comparatively small figures given as representing the consumption of gas for December, Mr. Lance says there should be remembered not only the circumstances mentioned, but also the very distinct preference shown locally for electric light. While he looks for such an early consumption of gas as will yield a revenue somewhat more than sufficient to cover working expenses, it is, he thinks, impossible under existing circumstances, to expect any very remunerative extension in that direction until a cheap coal can be obtained, and the price of gas reduced to what will successfully compete with paraffin. This result should be attained on the completion of the Delagoa Bay Railway, which will place Johannesburg in communication with the districts from which the Company now have to obtain coal by waggon. If only reasonable rates are given, he thinks the Company may expect to obtain the best coal at little, if any, more than half its present cost. When this is the case, although electricity may take the lead as a means of lighting among those to whom expense is not a great object, it is probable that there will be a large and profitable consumption of gas, without interfering with the prospects of the electric light department. The use of gas for cooking purposes has already been successfully commenced; and he looks for considerable extension in this direction, as well as in its use for gas-engines, some of which are already under order. The present capacity of the gas-works is equal to a production of 50,000 cubic feet per day, with a storeage of 60,000 cubic feet; but certain parts of the plant, such as the condensers, exhausters, scrubbers, purifiers, &c., are arranged for a production of four times this quantity. A further stack of retorts of the capacity of that already erected is on hand, as well as a second and larger holder for erection at a future date. In the electric light department, Mr. Lance says a good start has been made with excellent prospects as regards the future; this being undoubtedly the popular light in Johannesburg at the present time; the demand having hitherto been considerably in excess of what he has been able to supply. The present plant is serving nearly 2000 lights; and plant for an additional 1500 lights was expected to be in working order by the end of February. Questions have arisen as to the application of the Company's concessions to some of the suburbs of Johannesburg, Mr. Lance reports that sole rights of lighting have been secured in Doornforntein, Jeppe's Town, Marshall's Town, Fordsburg, and other suburbs. The land held by the Company consists of eight acres of ground in the vicinity of the new railway goods station; and as the right has been obtained to let such portions as are not required for works for a period of 99 years, this may be looked upon as a valuable asset, which, though not immediately yielding a revenue, may do so at no very distant date. He then goes on to say that the proved stability of, and the increasing output from, the Witwatersrand Gold Mines render the advance of the town of Johannesburg assured; and this, in turn, proves the great value of the important concessions held by the Company. The town is growing at a rapid rate; and its requirements for lighting must be such as ultimately to secure to the Company a handsome return. The results of the past year's work may not have been equal to the anticipations formed; but a fair start has been made, and the Company placed on the basis of a going concern, with excellent prospects. In conclusion, Mr. Lance acknowledges the services rendered by Mr. Cowie, the local Secretary, by Mr. W. Carr, who superintended the erection of the gas-works, by Mr. Davies, the Electrical Engineer, and by other officials and servants of the Company, throughout what has been a very trying time in the Company's existence.

The Directors, in their report (which is signed by Messrs. Davis and Soper, the Secretaries), remark that the statement by the Managing-Director is so exhaustive as to obviate the necessity for further observations on their part. They point out, however, its three important features—viz., the extension of the concessions, the holding of surplus lands for the term of 99 years, and the advantage attaching to the concessions.

With regard to the accounts, they remark that all the debentures have been sold, with the exception of £3350 reserved. With reference to the large amount (£7649) appearing as loss on the profit and loss account, the Directors point out that the supply of lighting commenced, as to electricity on the 24th of April, and as to gas on the 20th of June last year, whereas the expenditure began, as to the former, two months, and as to the latter, four months previously. This expenditure has all been debited to the revenue account. It is obvious, they remark, that the ratio of expenditure to revenue in an industrial enterprise must necessarily be disproportionate during at least the first twelve months of the running of the concern. Having regard to the existing arrangements for the suburbs of Johannesburg, and to the rapid extension both of the town and residential districts, the present capital of the Company is becoming inadequate to meet the pressing demands of the inhabitants.

HARROW DISTRICT GAS COMPANY.

The Half-Yearly Meeting of this Company was held on Monday last week at Winchester House, Old Broad Street, E.C.—Mr. JAMES GLAISHER, F.R.S., in the chair.

The SECRETARY and ENGINEER (Mr. J. L. Chapman) read the advertisement convening the meeting; and the Directors' report and the accounts, which were noticed in the JOURNAL on the 21st ult., were taken as read.

The CHAIRMAN said that few remarks were needed from him in moving the adoption of the report and accounts, as they were very similar to those they had had for several half years past. Looking at the income side of the revenue account, it was seen that, compared with the corresponding period of 1891, the sales of gas had increased by about £95; and meter and stove rentals, by £8. This was quite the normal increase of the neighbourhood. The receipts for residual products had all fallen—coke, by about £50; tar, by £59; and sulphate, by £9; making £118. These figures showed that the total revenue was £16 less—£5009, as against £5025. Directing attention to the other side of the account, he said that they had paid £34 more for coal, but had carbonized an additional 42 tons. But here they saw something which was peculiar in respect to the Harrow Company—that their coal had cost more, while most companies had had to pay less. But other companies last year had a difficulty in paying their full dividends; while in their own case they had not. This was owing to the foresight of their Engineer in purchasing the coal, by which he obtained his supply as cheaply in the past year as in the previous one. However, they now hoped to make even better arrangements, and so get a supply of coal at a less price. The total expenditure was £11 less than in the December half of 1891—£3325, as compared with £3336—so that there was only a decrease of £5 in the profits. No doubt the matter in which the shareholders were most interested was the negotiations which had taken place with the Directors of the Great Stanmore Gas Company, with a view to the fusion of the undertakings. As the report stated, they had arrived at an agreement, which had already received the unanimous approval of the shareholders of both Companies; and a Bill would be promoted in the next session of Parliament to give full effect to the contract. The Great Stanmore works were built under the direction of their late Deputy-Chairman (Mr. John Chapman), who, a few years later, constructed the Harrow works. During the time Mr. Chapman was the lessee of the Great Stanmore undertaking, he paid 6 per cent. on the capital. The shareholders had often heard him (the Chairman) complain of the slow progress of Harrow; they wanted a little more life. He had been over Stanmore, and was exceedingly pleased with what he saw of it. It was situated north-east of their own district—abutting on it—and was bounded by the Watford Gas Company, the Elstree and Boreham Wood Company, the North Middlesex Company, and The Gaslight and Coke Company. The Company had a revenue of upwards of £2000 a year, and was very prosperous; and the place was progressing at a fast rate. He felt confident the arrangement would be attended with great benefit to both Companies. They would only require one Manager and one Board of Directors; and many expenses would be avoided which were now necessary.

Mr. C. HORSLEY, J.P., seconded the motion, which was carried without discussion.

Resolutions were passed, agreeing to the writing off of £250 out of the remaining £500 of parliamentary expenses, and to the payment of dividends of 7½, 7, and 5¾ per cent. on the various classes of capital of the Company.

Mr. A. H. BAYNES then proposed, and Mr. HORSLEY seconded, the re-election of the retiring Director (Mr. James Glaisher). This having been unanimously passed, the retiring Auditor (Mr. J. Randall) was re-appointed.

On the motion of Mr. A. F. PHILLIPS, seconded by Mr. HORACE RYDON, the services of the Chairman and Directors and the Engineer and Secretary were suitably acknowledged.

This concluded the proceedings.

AN ELECTRIC LIGHTING SCHEME FOR LANCASTER.

The Electric Lighting Committee submitted at the last meeting of the Lancaster Town Council a report containing an outline of a scheme for an installation of the electric light for the borough, and a recommendation that £17,692 should be spent in carrying it out. They have decided not to put down the whole of the machinery included in the scheme as originally proposed, but to erect only a portion. It is intended, however, to at once make provision, so far as the cables and buildings are concerned, for the supply of energy for 6000 16-candle power lamps; this being in accordance with the original plan. The system considered most suitable is the low-tension continuous current. The plant to be installed consists of Lancashire boilers, Green's economizers, Willan's engines, coupled direct to Brush dynamos, condensers, switchboards, and accumulators. The tender recommended for adoption by the Committee was submitted by the Brush Electrical Engineering Company, amounting to £12,683. This is exclusive of the cost of the buildings and the laying of the mains, which the Corporation propose to carry out, at an estimated expenditure of £5000. The Committee expect that the installation will pay its own way with a charge of 7d. per unit. From the remarks made by Mr. Smith, in moving the adoption of the report, it appears that the Committee had before them the alternative of proceeding with a scheme, or losing the powers they had obtained, and having the electric light established in the borough by a private company. They had also, he said, the fact to consider that the light had advanced beyond the experimental stage; and any improvements that might be made would be confined to a few details. It was to be remembered that the present accommodation for the manufacture of gas was tested to its utmost limits; and if they did not soon adopt the electric light, they would have to face a considerable expenditure in the enlargement of the gas-works. The Committee thought it would be a very unwise step to embark upon an expenditure to supply an increased quantity of gas, when they had power to undertake the introduction of "the better and softer light." At the last moment, they had somewhat modified their plans, and had reduced the generating plant to two-thirds the amount originally intended—that was, plant for the supply of 4000 16-candle lamps or 8000 8-candle lamps, instead of 6000 and 12,000. As to the question of cost to the consumers, this was one of some difficulty. The Board of Trade would not allow them to charge more than 8d. per unit; and, roughly speaking, this would be something like double the cost of gas at the present time. But if they could have a demand for a supply lasting all over the 24 hours—he had made a very careful calculation—they could make, distribute, and sell it at a profit, which would allow ample margin for depreciation and for redemption of capital, for 1d. per unit, which would be about one-fourth the price of gas. Of course, he did not expect there would be anything like this demand; and he simply quoted it to show the immense difference existing between the maximum price and what might be the cost in case of an excessive demand. Mr. Bell seconded the motion. Among the members who took part in the discussion was Alderman Hatch, who said that, if the scheme were adopted, he should insist upon a proper and strict account being kept of the cost to the town, as those people who were in love with the light ought to pay for it. The report was agreed to.

A Large Water Scheme for the Supply of Villages.—The Evesham Rural Sanitary Authority last week adopted a scheme, proposed by Mr. J. E. Willcox, C.E., of Birmingham, for the supply of water to fifteen villages in the Union, at an estimated outlay of £11,600. The cost per 1000 gallons (including mains, reservoirs, and other works) will be 8·86d.; while the price now paid for water by the Authority to the Evesham Corporation is 1s. 4d. per 1000 gallons. The mains will extend over 35 miles.

Exmouth Gas Company.—The fiftieth annual general meeting of this Company was held on the 28th ult., when the Directors reported a balance of £1196 available for division. They recommended the payment of the usual dividends—viz., of 10 and 7 per cent. This would, they said, absorb £640, and leave £556 to be carried forward. During the past year considerable improvements were made at the works by the erection of sulphate of ammonia plant, a Livesey washer, a bench of six retorts, and a new hydraulic main in sections, with a separate tar-main, and a 10-inch steel foul main. Alterations and extensions of the distributing system were likewise carried out, to meet the requirements of the consumers. The report was adopted

Opening of New Water-Works for Norton.—The new water-works just completed for the Norton (Malton) Local Board were inaugurated yesterday week, in the presence of the members and officials of the Norton and Malton Local Boards, and a large gathering of the public. The well from which the supply is drawn is situated at the foot of Home Hill; and the reservoir is at the top of the hill. The water is pumped up, by a Crossley gas-engine, at the rate of 1000 gallons an hour; and the reservoir holds 25,000 gallons. The water is then conveyed to the town by gravitation. Messrs. Fairbank and Son, of Westminster and Driffield, were the Engineers; Mr. Bell, of Market Weighton, contractor for the reservoir; and Mr. Villiers, of Beverley, for the well and pumping machinery.

West Gloucestershire Water Company.—The half-yearly meeting of this Company was held last Saturday week. The report submitted stated that, during the six months ending on the 4th ult., 259 additional services were laid on; making the total number of properties supplied by the Company 3928, and which, together with some meter and miscellaneous supplies, were estimated to produce a rental of £3145 per annum. After paying all working expenses, together with interest on the perpetual 4 per cent. debenture stock and special loan, there remained a net profit of £254, which was nearly 1 per cent. on the subscribed share capital. Assuming the normal growth of the revenue to be maintained, the first dividend will be declared at the next half-yearly meeting. The Directors recorded their deep regret at the death of their Engineer (Mr. H. J. Marten, M.Inst.C.E.), and mentioned that they had appointed his son (Mr. E. D. Marten, M.A., Assoc.M.Inst.C.E.) to succeed him. The report, which was considered to be exceedingly satisfactory, was adopted.

EAST LONDON WATER-WORKS COMPANY.

The Half-Yearly General Assembly of the proprietors in this Company was held on Monday last week, at the Offices, St. Helen's Place, Bishopsgate Street—Mr. GEORGE BANBURY in the chair.

The SECRETARY (Mr. I. A. Crookenden) read the notice calling the meeting; and the report and the statement of accounts, which were summarized in last week's issue, were taken as read.

The CHAIRMAN said they had all hoped that Mr. Gadesden would have regained sufficient strength after his illness to have been able to resume his place as Chairman; but, unfortunately, he had deemed it wise, much to his own regret, and still more to the regret of the Directors, to resign the chairmanship. He was, however, happy to state that they would still keep Mr. Gadesden on the Board; so that they would continue to have the benefit of his experience, his wise counsel, and his most intimate knowledge of everything connected with machinery. The honour that the Board had just conferred upon himself was especially gratifying to him personally, for "East London" had ever been a household word in their family—his father was one of the earliest shareholders, and their home at Warlies was in the neighbourhood of the Lea Valley, whence the Company derived their main supply. Turning to the accounts, he thought they might say they had had a comfortable half year. The increase in the meter-rates did not show quite so much progress as in the corresponding period of the previous year; but still they were £1206 to the good. Had they not lost two or three large manufacturing firms, owing to weakened trade, the meter revenue would have reached a very pleasing figure. They had had a satisfactory increase in the domestic supplies; but the district was so poor that their remuneration was at times inadequate, while sometimes there was no remuneration at all in the returns they received. Still, in the past half year there had been an improvement in this respect; and the annual average rate per house had been better than formerly. On a previous occasion, he mentioned that, owing to the great poverty of their neighbourhood, and the poor class of property in the East London district, they supplied many houses at a loss; but this philanthropy by Act of Parliament was part and parcel of their system. He remembered Mr. Pember once remarked: "It is admitted on all hands that there is a certain communistic element in the principle upon which water-rates are adjusted. There is no doubt that to some extent the rich under it do pay more than the poor." Mr. Pember might have said "pay *for* the poor." Where corporations and municipalities had control of the supply, this forced benevolence was to a great extent lessened by their putting on a minimum rate, below which the charge for water could not fall. Thus the lower-rated houses in the East London district paid less than in Bolton, Blackburn, Bristol, and other towns. With reference to their works, he was happy to say that the Lea Bridge well yielded a plentiful supply. They had, in fact, been drowned out; and, although they pumped more than 3 million gallons a day, they could not reduce the level sufficiently for the workmen to go in and set to work again at the headings. The shareholders might remember, with respect to this well, that they had a great deal of trouble at first. But, after considerable perseverance, they came across some very bountiful fissures; and although they had to drive over a mile of adits, these formed a most valuable underground reservoir. He trusted that the Walthamstow well might prove as successful as the one at Waltham Abbey, as, with only 200 yards of adits, they were getting upwards of 2 million gallons a day. The well at Chingford was going on satisfactorily; and they knew that the water was there, as it was by the side of the old productive borehole. The four large triple expansion engines were doing all they could wish; and they worked most successfully and more economically even than had been anticipated. The balance-sheet showed that they saved in pumping and engine charges £2120, compared with the corresponding six months of the previous year, when the old plant was in use. They would want two more triple expansion engines to supply the Essex district—one would be erected at Walthamstow, and the other at Lea Bridge. These engines were now being constructed by Messrs. Harvey and Co., at Hayle. The shareholders would expect him to say a few words with regard to the Royal Commission. Inquiries into the London Water Supply had lately assumed an appearance of perpetuity, which certainly seemed rather alarming. The Corporation first tried their hand; then came Sir Matthew White Ridley's Committee in 1891; in the following year, the Royal Commission commenced their sittings; and now, even before their report was issued, down came the County Council asking for any amount of money from the rates in order to prosecute further inquiries. After Sir Matthew Ridley's favourable report upon them, and the voluminous evidence given before the Royal Commission, it would seem incomprehensible to the ordinary mind what there could be so inscrutable and so esoteric in the conduct of their business as to necessitate still further investigations, more especially when it was remembered that all their proceedings, both financial and executive, were under the control of the Government. There could really be nothing behind the scenes; and everything, in fact, was above-board. He need hardly tell the shareholders that these investigations caused them much expenditure of time, labour, and money. He thought he was not wrong, at a rough guess, in saying that the Parliamentary Committee of 1891 and the Royal Commission had cost the Companies at the very least £25,000. Fortunately, they must not consider this money as altogether thrown away, or as entirely a bad investment, because their position was strengthened, and their reputation more than maintained, by the Parliamentary Committee of 1891; while, from what they had heard of the evidence given before the Royal Commission, they might reasonably hope that their report would be favourable to them. It would not be proper for him to try and anticipate the report of the Royal Commission; but there was no harm in stating that the evidence as to the complete efficacy of their filtration had been such as not only to surprise the Commissioners and the Companies, but even the scientific witnesses themselves. No one apparently had been aware that the filtration as now carried on removed from 98 to 99·7 per cent. of the microbe organisms, and that it was very difficult indeed to find any pathogenic germs after the water had passed through their filter-beds.

In fact, quite a new light had been thrown upon the subject of filtration by the inquiries of Dr. Frankland and Messrs. Odling and Crookes, and other scientific chemists, the result of whose investigations had been very favourable to the Companies. Thus, the Government analyst remarked that, "by careful filtration, as ordinarily practised by the Water Companies, the raw Thames and Lea waters may be converted into a beverage which is bacterially equal to that from deep wells in the chalk." He did not think that anything could be much more satisfactory than that. The geological evidence given before the Commission showed that there was no doubt a large volume of water in the chalk in the basin of the Lea which was ever passing away seaward, and that only a very small portion of this water was intercepted by the Company's wells. No proof was produced that their wells in any way affected the supply in Hertfordshire—in fact, the scientific evidence showed there was no ground for this assumption. Just before the curtain fell upon the Royal Commission, Dr. Frankland made a statement in evidence which had attracted considerable attention—probably because he knew as much about the matter as anyone else. Dr. Frankland said, "I would summarize by saying that in my opinion, there is, in the Thames basin, an ample supply of excellent water for the wants of the Metropolis for the next 100 years at least; and that, in my opinion, there is no necessity to go outside the Thames basin." Rather an amusing piece of evidence was given to the Commission one day when he (the Chairman) was present, by Dr. Klein, who was called in order to give evidence on behalf of the County Council. Dr. Klein stated that, in his judgment, no kind of filtration could completely destroy every possible risk of danger. Sir Archibald Geikie then asked him if he had ever analyzed any aërated water. Dr. Klein replied: "Yes, I examined one sample of aërated water advertised as 'absolutely pure;' but, when tested, it does not come out so very pure. I found in one sample 21 colonies of microbes per cubic centimetre, and in another 41 colonies; whilst I found, on the same day, that the West Middlesex water was purer, as the colonies were fewer." The question of storeage reservoirs was under investigation during the latter sittings of the Royal Commission; and it would doubtless be one of the subjects reported upon. The report sent in regarding the storing of Thames waters, as worked out by Messrs. Hunter and Fraser, of the Grand Junction Company, was so favourably received by the Royal Commission that they asked the East London Company to send in a similar project for the Lea Valley. They touched on this subject in a statement they had previously submitted to the Royal Commission. Mr. Bryan, therefore, provided the necessary plans, and gave evidence. There was nothing hazardous or speculative in Mr. Bryan's proposals. The beds of the reservoirs would be on London clay, and would be filled by gravitation. There would be little or no interference with private rights, nor submerging of houses, barns, or other tenements; and he might say that they had already obtained a portion of the land. Another favourable feature in connection with this scheme was that these contemplated reservoirs need not be built all at once; they could be constructed as the necessity for them arose. Thus, in the first instance, they would increase the present storeage to 1200 million gallons, which would secure them from any danger in case of drought. He might add that these works would be only an extension of the 220 acres of storeage which, by the foresight of their predecessors, they already possessed at Walthamstow, and which enabled them to supply the district continuously and satisfactorily. He said "satisfactorily," because the following extract from the recent report of Dr. Frankland, the Government analyst, showed clearly how extremely valuable these large subsidence receptacles were in purifying the water before it passed on to the filter-beds. The report ran thus: "Contrasted with raw river water at the East London intake, the water delivered upon the filters after 13·7 days' storeage exhibited a bacterial improvement of no less than 97·8 per cent." Their Engineer's reputation stood as high throughout the district as it did in the Board-room. It was mainly owing to Mr. Bryan that they were now paying 8 per cent., and could see their way to being able very shortly to supply 8 million gallons per day of pure chalk water to their resident population. As to the Secretary and his staff, when they considered that the Company supplied nearly 1,250,000 inhabitants without any complaints, and, what was still more remarkable, with only £352 of bad debts, out of a revenue of £137,000 during the past half year, it spoke much for the satisfactory and conciliatory manner in which the work was carried on. Mr. Crookenden fully recognized the important principle that the interests of their customers and of the shareholders were identical—a point prominently brought forward in Lord Knutsford's speech at the last meeting of the Grand Junction Company. The proprietors were doubtless aware that, in order thoroughly to carry out their obligations to an increasing population, they went to Parliament with a Bill to raise more capital. Some misapprehension had existed as to the object of this Bill, which he would endeavour to clear up in a few words. Unless more money had been actually required for new works, they would not have been so silly as to raise a large amount of debenture stock in front of their ordinary stock, nor would they have wanted to issue it except from time to time as the necessity arose. They could have no ulterior motive, as they obtained no profit from the issue, or the interest derived therefrom. The issue, under the auction clauses, was by tender; and the interest earned went to the fund held by the City Chamberlain for the benefit of the public. In the Bill, two clauses were incorporated—one as regarded the occupation of some Lammas lands, and the other to ensure that proper fittings should in future be fixed in houses, instead of the rubbishy things now so commonly used. The question of the Lammas lands resulted in a satisfactory agreement; and, although the fittings clause was in the interest of the householders, and was only in a line with similar provisions in the Water Acts of many corporations and municipalities, it met with some criticism, and was consequently withdrawn. Thus the Bill asked for nothing more than power to raise money; and they had expected that it would, in the ordinary course, be referred to a Select Committee. It was, however, opposed on the second reading by the London County Council; and, although the Chairman of Committees and many other members spoke strongly in their favour, the Bill was thrown out by a majority of 24—their opponents' ranks comprising 8 Welsh members, 23 Scotch, and 57 Irish, who could really know but little of the Lea Valley and the requirements of East London. The immediate result of this division would be to prevent their carrying out for the benefit of the public that extension of their reservoirs which he had mentioned; and for which they had already obtained the necessary land. The extension was also very much desired by General De Courcy Scott, of the Local Government Board; and it would have been an immense benefit in securing a continuous supply, as well as in making that supply even purer than it now was. Should there be a scarcity hereafter in dry seasons, the responsibility would rest, not with the Company, but upon the House of Commons, as pointed out by the Chairman of Ways and Means, when he stated that it would be unprecedented if the Bill were not sent to Committee. One of their chief opponents apparently seemed to think well of the Company after all, as he said: "How can the East London Company want money when it supplies more water per head, and has more storeage, than any other Company?" One most remarkable argument was used against the Company, and, what was more remarkable still, persons were found who were not able to see the fallacy of it. Members were gravely told that the Company had shown before the Royal Commission that there was a large body of water available in the Lea Valley, and that the Company could not possibly want any more capital. Could people suppose that this water would be filtered spontaneously, and that it would then flow into new houses, and into their baths and cisterns 25 and 30 feet from the pavement, by some automatic process? Could they not see that filter-beds, mains, pipes, pumps, and other expensive paraphernalia were necessary to lay on the new supply to those who required it? They had, however, to thank a good many Members for the help which they rendered to the Company during the progress of the Bill. He concluded by moving—"That the Directors' report and accounts submitted to the meeting be received and adopted, and that, as recommended by the Directors, a dividend of 4 per cent. (less income-tax) on the ordinary stock of the Company be declared payable on the 10th of April next."

Mr. H. DALTON seconded the motion, which was at once carried unanimously.

Resolutions were afterwards passed re-electing the retiring Directors (Mr. Dalton, Dr. W. Smiles, and Mr. H. Helme), re-appointing Mr. F. Tendron an Auditor, and electing Mr. W. H. Long, M.P., a Director in the room of the late Captain Hugh Davis, R.N.

Dr. CHESSHIRE then proposed a vote of thanks to the Chairman and Directors.

Mr. ILSLEY, in seconding the motion, observed that the Directors now had not only to conduct the business of the Company as a Water Company, but also to discharge other duties of equal importance—that was to say, in meeting those who were called "progressives." Formerly they had no such difficulties to contend against; but now it was of very great importance that the Directors should not only be able to look after the supply of so much water to the customers, but they should also be able to defend the rights of the proprietors. He was quite sure that, without this defence, they would soon "go to the wall." In the present day such enterprises as theirs seemed to be regarded as a mark to be shot at, and for the most part by those who possessed nothing. It seemed to be merging into a battle between those who had something and those who had nothing.

The resolution was unanimously adopted.

On the motion of the CHAIRMAN, seconded by Dr. CHESSHIRE, a vote of thanks was also passed to Mr. Bryan and Mr. Crookenden and their respective staffs.

The proceedings then terminated.

A New Water Reservoir for Bath.—The Water Committee of the Bath Town Council some time ago, with the view of augmenting the water supply of the city, presented a scheme for acquiring additional springs in the St. Catherine's Valley; but certain of the owners would not come to terms, and opposition was threatened by the Rural Sanitary Authority, who urged that the absorption of the springs would interfere with the sanitary arrangements of the large village of Batheaston. The Council passed the scheme; but it was objected to by the Local Government Board, who regarded the proposal simply as a stop-gap, which would not permanently afford the extra water. Mr. Fox, C.E., of Westminster, was then called in; and he approved a scheme for constructing a large reservoir at Monkswood, as originally proposed by the Assistant City Engineer, Mr. C. Gilby. This will be of a capacity of 50 million gallons, and cover 10½ acres of land; and the cost is estimated at £30,000. Upon the recommendation of the Water Committee, the Council have decided, by 27 votes to 6, to construct the reservoir.

The Testing of Private Gas-Meters.—Last Saturday week, Mr. E. C. Twiss, the Stipendiary Magistrate of Hull, gave judgment in a matter in which the British Gaslight Company, Limited, had been sued, by a gas-fitter named Vaughan, for refusing to supply him with gas for a period of ten days. The case was heard in February last; and from the evidence then adduced, it appeared that the complainant made application to the Company for a supply of gas on Dec. 5, 1891. A meter was taken to his house, but was refused, on account of it being a wet one. In the following July, Vaughan visited the Company's office, and stated that he had purchased a dry meter; and he was informed that it would have to be tested by one of their inspectors. This he would not permit; but the meter was afterwards tested by the Corporation assistant-inspector of weights and measures (Mr. Cooper), Mr. Kemp, who appeared for the Company, contended, first, that Mr. Cooper was not the sworn inspector under the Sale of Gas Act, 1859; and therefore not the prescribed authority to test the meter which complainant had purchased. Secondly, that complainant did not comply with the provisions of the Act in refusing to allow the Company to test the meter by means of appliances on their own premises. One of the witnesses mentioned in his evidence that, out of 14,000 meters in the Company's district, only 191 were private ones; and there was not one dry meter to every ten wet. On the first of the above points, the learned Stipendiary found that the assistant inspector was not duly qualified; and, on the second, he held that the request of the Company to be allowed to test the meter on their own premises was a reasonable one. The summons was accordingly dismissed.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Mr. James M'Gilchrist, of Dumbarton, who is Convener of the informal meeting of Gas Managers in Scotland, and who is also practically the Committee, has issued circulars intimating that the meeting this year—the tenth—will be held in the Victoria Hotel, Glasgow, on Wednesday, the 12th inst. Mr. A. Wilson, the Manager of the Dawsholm works of the Glasgow Corporation, will preside. After being "informally" convened, the meeting will at once adjourn, and take train to the Great Western Road Railway Station, from whence they will proceed to the Temple Farm Gas-Works of the Corporation, adjoining the Dawsholm works, and also under Mr. Wilson's charge. There, upon the kind invitation of Mr. W. Foulis, the Engineer of the Glasgow Gas Trust, they will inspect the 6 million cubic feet gasholder which is in course of construction. Returning to the hotel, the President will deliver an address upon subjects of interest to the gas industry. According to custom, the meeting will then be thrown open; and gentlemen will have an opportunity of submitting anything which they may consider of value to their brethren. A dinner will follow, at which Mr. Wilson will also preside. The meetings are always extremely interesting; and, considering the number of important subjects which have been before gas managers during the year, there is every reason to expect that Mr. M'Gilchrist and Mr. Wilson will be able to "engineer" a successful gathering this time.

Peebles continues to be visited by large numbers of gas managers, to see Mr. Young's oil-gas plant. Recently the Managers of the St. Albans and St. Helens Gas-Works have been there, as well as gentlemen from other places. Everyone is admitted and shown over the works, and gets the fullest information as to the operation of the process and its results. The number of visitors is in fact so large that it is a wonder how Mr. Bell, the Manager of the works and co-patentee with Mr. Young, is able to carry on his daily duties with efficiency; but the generous policy which is being followed will doubtless have its reward in many places deciding to adopt the process.

A closer scrutiny of Professor Kennedy's report to the Edinburgh Corporation upon their proposed electric lighting installation reveals a most extraordinary handling of figures which it surprises me the Corporation have not yet discovered. The Professor advises the Corporation that in three years they might have 40,000 8-candle lamps on circuit, which at an average of about 8s. 6d. per lamp per annum, would realize a revenue of £17,100. "This estimated income," he says, "corresponds to a sale of 342,000 units per annum." As he recommends the unit to be sold at 6d., I calculate the revenue from the above number of units to be £8550, which is exactly half what he says they might expect from the 40,000 lamps at about 8s. 6d. each per annum. Which of his conclusions is wrong? I find that, in his report to the Belfast Corporation, he states that an 8-candle lamp would use about 17·5 units per annum. If that were so, then 40,000 lamps in Edinburgh would use about 350,000 units per annum; so the 342,000 units may be taken as correct, and the £17,100 to be wrong. This is most serious, because, if half of the expected revenue be cut away, how are the profits to be affected. Then he estimates salaries, wages, fuel, stores, renewals, and maintenance, by the time they are selling 300,000 units per annum, at 2·5d. per unit, which works out at £3125; establishment charges and general office expenses, at not more than 0·5d. per unit, which would be £625; and interest on borrowed money, at 3 per cent., 2·4d. per unit, which would be about £3000. These three sums together make £6750. Over and above this, there is the sums to be set aside for the sinking fund and the reserve fund—say, 2 per cent. on the capital of £100,000 that he suggests—which would make a further £2000, and would bring the total charges up to £8750, or a deficiency of £200. Thus, on his own showing, there would be a loss on the business. Whether or not his estimated costs are open to question, I am perhaps less able to speak than would be some of your more practical readers; but I cannot think that in the city of Edinburgh an office could be provided, kept clean and lighted, and furnished with all the equipments of stationery, printing, &c., for £625 a year. These charges upon the Gas Commission last year amounted to £1920. Neither do I think it likely that the salaries of an engineer, inspector, and collector, with the wages of workmen and clerks, fuel to raise steam for engines of 1400 indicated horse power, renewals and maintenance, could be met by an annual outlay of £3125. On this subject, however, the accounts of other installations would be valuable. I understand that the Committee of the Corporation are having some difficulty in fixing upon a site for their electrical station. For the sake of economy, the Lord Provost is anxious that it should be beside the Water of Leith, in order than an abundant supply of water might be obtained; but any site which could be procured near the water that would be convenient for the area to be supplied, would be unprovided with railway accommodation, and the cost of carting materials to it would about balance any saving in the production of steam to be derived from proximity to the stream.

"When gas is of so bad a quality and so high a price, the public generally ought to know that oil is cheaper and produces a purer atmosphere than gas." So said Mr. John Laing, F.I.C., M.S.A., of London, in a paper on the burning of oils with safety in lamps and stoves which he read before the Edinburgh Association of Science and Art, on Monday, the 20th ult. Mr. Laing may be a scientist; but if he is, his science seems scarcely to be of that impartial order which has always been regarded as the characteristic feature of all inquiries into the mysteries of Nature. When he speaks of the "quality" of gas, I take it that he means illuminating power—an inaccuracy of which a scientist ought not to be guilty. I also imagine that he was speaking of Edinburgh gas, because the supply of bad gas in London would be no reason for recommending people in Scotland to burn oil. If he meant Edinburgh gas, where was his authority for saying that it is bad? He cannot have read the reports of Mr. Ivison Macadam upon this matter. As to price, if he means that Edinburgh gas is specially dear, he is wrong again, because it is of 25-candle power, and is sold at 3s. 9d. per 1000 cubic feet, which is equal to a charge of 2s. 5d. for 16-candle gas. Then, on the other side of the question, where is his authority for saying that the atmosphere of a room in which oil is burned is purer than that of one in which gas is consumed? The common impression is that oil gives off, when burned, most offensive and objectionable vapours. If it be said that it is possible to employ it without this being done, the reply is, "So can gas;" and the question is thus reduced to one of fittings. I have made these remarks because Mr. Laing seemed to me to most unwarrantably go out of his way to attack a sister industry. It was open to him to advocate his own business without proclaiming the demerits of another's; but, if he wished to institute comparisons, he should have been careful that he proceeded upon accurate data, and not have simply given his impressions (for this seems to be all he did), and these not very reliable.

Sulphate of ammonia continues to rise in price. In Glasgow this week it has been sold as high as £13 per ton, which contrasts well with £9 15s. obtained no further back than five weeks ago. With Lord Beaconsfield's well-known remark in my mind, about a rise in the price of acids denoting the advent of prosperous times in commerce, I asked a friend of mine in the chemical world the other day whether there was a general rise in his line; but he lugubriously assured me that there was not. From this, I conclude that the present agitation in the sulphate market is only temporary, and that it will not be safe to build too high expectations upon it.

As the result of negotiations between the Aberdeen Corporation and the Great North of Scotland Railway Company, the latter body have agreed to abandon their proposed scheme for supplying themselves with water within the area of the Corporation; and rates have been fixed for the supply which the Railway Company are to take from the Corporation.

We have received several letters in reference to the final paragraph of our Scotch Correspondent's "Notes" last week, on the subject of the ammonia plant at the Clyde Iron Company's works. It appears that the Company employed Mr. A. Gillespie, of Glasgow, to prepare the plans of the plant, which is for four blast-furnaces; and it was carried out under his superintendence. The contract for the larger portion of the work was entrusted to the Barrowfield Iron-Works, Limited, of Glasgow and London; the sulphate plant being designed and erected by Mr. Maurice Schwab, of Manchester. The latter comprises stills and one of Wilton's patent saturators, discharging into trucks on an overhead railway, and tipping the sulphate direct into store-room. This is believed to be the most complete set of sulphate apparatus ever erected in the United Kingdom. The entire plant is expected to be in operation this week. We may mention, in connection with this matter, that Mr. Gillespie has just completed ammonia plant similar to that at the Clyde Company's works for six blast-furnaces at the Dalmellington Iron-Works; and that the whole of the ammonia plant at the Coltness Iron-Works, Newmains, was supplied and erected by the Barrowfield Iron-Works.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *March* 30.

Sulphate of Ammonia.—If the tone at the close of the month is from all appearances a little quieter, it must be taken as due more to the advent of the Easter holidays, than to any change of position or feeling. It must not be forgotten that, if quietness should prevail for a few days, the cause does not lie in the cessation of the requirements, but purely and simply in the want of supplies, which is becoming more severely felt day by day. When the shipments furnish such a strong point, comment is needless; and the summerlike weather causes a more than usual falling off in the production, at the same time stimulating a demand before the ordinary period—factors which can scarcely be overlooked. £12 12s. 6d. to £12 15s. is named as the spot price. Early April delivery can probably be bought at £12 10s.; but there may be greater surprises in store in the coming month than even during that just ended. Nitrate is stronger; quotations being 10s. 6d. per cwt.

LONDON, *March* 30.

Tar Products.—Very little new business is reported in this market. Benzols are distinctly flat, and are likely to remain so until the holidays are turned, and buyers are compelled to supplement their reduced stocks. If anything, a better feeling obtains as to pitch; and opinion differs widely as to the future of this product. Creosote and common oils are neglected; and the same remark applies to solvent naphtha. Tar acids are selling freely; and the Tar Products Sales Committee's prices for them are easily obtained. Business has been done during the week at the following rates: Tar, 12s. to 13s. 3d. per ton. Pitch, 24s. to 25s. 6d. Benzols, 90's, 1s. 8d.; 50's, 1s. 6d. Solvent naphtha, 1s. 1½d. Toluol, 1s. 4½d. Crude benzol naphtha, 30 per cent., 7d. Creosote, ¾d. Creosote salts, 17s. Carbolic acid, 60's, 2s. 4d.; 75's, 2s. 10½d.; crystals, 7½d. Cresol, 2s. Anthracene, nominal, 30 per cent., "A," 1s. 1d.; "B," 9d.

Sulphate of Ammonia is very scarce; and the end of the month has found sellers lamentably short of quantities sold. The market continues inflated; and, judging from the position of stocks, and the prospective demand, it looks as if the present prices will prevail for some little time to come. Gas liquor is quoted at 8s. 6d. to 9s 6d.

Extensions at the Haverhill Gas-Works.—The Manager of the Haverhill Local Board Gas-Works (Mr. B. Gibson) lately presented to the Gas Committee an estimate of the cost of carrying out certain extensions at the gas-works. They comprise the telescoping of the largest gasholder, the addition of another scrubber, washer, and exhauster, the erection of an oxide shed, and the laying of a main necessitated by the projected use of gas at the proposed water-works. The Committee duly reported this matter to the Board, and the proposals were agreed to—the Clerk being instructed to make the necessary application for borrowing £1250, the estimated cost of carrying them into effect.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—All descriptions of round coal gradually become more difficult to move, and stocks accumulate at most of the collieries, notwithstanding the restricted output of not more than four days per week, and the stoppages for Easter which, in many cases extend over quite four days. The month opens without any actually quoted alteration in list rates; and in the Manchester district the leading collieries are generally firm in holding to their prices for house-fire qualities. In other districts, however, there is a weakening tendency; while as regards common round coals, list rates are simply nominal—sellers in the majority of cases scarcely adhering to any fixed price when there is business to be obtained. Inquiries for gas-making coals have not yet come upon the market; and it is probable they may be held back, pending the course of events with regard to wages, as colliery proprietors have so frequently declared that, unless wages can be lowered, they are in no position to take anything under last year's figures. Notwithstanding this, however, all descriptions of round coal are steadily easing down; and best Wigan Arley could now be bought at about 11s. 6d. to 12s., with Pemberton four-feet and second qualities of Arley not averaging more than 10s., and common house-fire coals readily obtainable at 7s. 6d. to 8s., and steam and forge coals at 6s. 6d. to 7s. per ton at the pit mouth. The resumption of work at the cotton-mills has necessarily brought upon the market an increased enquiry for engine fuel; and as supplies, owing to the very limited production of slack, were previously anything but plentiful, it is more than probable that consumers will experience considerable difficulty in securing requirements. At the pit mouth, burgy fetches fully 6s. to 6s. 6d.; the better qualities of slack, 4s. 9d. to 5s. 3d.; and lower qualities, 3s. 6d. to 4s. per ton.

Northern Coal Trade.—With the interruption of the holidays, there has been anticipatory business in some of the branches of the coal trade of the north-east. Best Northumbrian steam-coal is still quoted at 8s. 6d. per ton, f.o.b.; and most of the collieries have now fairly full work, with in some instances a week's turn on. Second-class steam coal may be put at about 8s. per ton, f.o.b. Small steam-coals are 3s. to 3s. 3d. per ton; and they are more abundant than a month or so ago. Bunker coals can be had in any quantity; and as the consumption is small, the price is very weak. Fair bunker coals, unscreened, may be had from 6s. to 6s. 6d. per ton; while the best Durham screened qualities sell at 8s. 3d. per ton. For manufacturing coals, there is a fair demand; but threatened labour interruptions might affect the consumption. Household coals show a falling demand; and there are many complaints as to the high prices that are still locally charged. In the gas-coal trade, there is a fair demand for the season; but the prices seem, on the whole, weaker than they were, though the interruption of holidays has lessened the glut of coals in the market. Prices vary from 6s. to 6s. 3d., f.o.b., for best Durham coals. A contract for the supply of a Tyneside town is expected to be given out at from 6s. to 6s. 1½d. per ton; but the exact price will be to some extent dependent on the mode of delivery. Some of the tenders, however, are at much higher rates. Coke is fairly steady, at from 13s. 6d. to 14s. per ton, f.o.b. Gas coke is quoted at about 7s. per ton, though there are contracts below this rate for some of the local cement works on the Tyne.

Scotch Coal Trade.—The spurt attendant upon the opening of the Baltic ports may be said to be over; and it has led to no benefit in the matter of prices. There is still a disinclination to quote forward, and a slack demand for home consumption. Steam and splint are not going off well, nor is the outlook for them encouraging. The prices quoted are: Main, 6s. 3d. to 6s. 4d.; ell, 7s. to 7s. 3d.; splint, 6s. 6d. to 6s. 9d.; and steam, 8s. to 8s. 3d. per ton, f.o.b. Glasgow. During the past week, there was a large export from the east coast ports; while those in the west mostly showed a decline. Over all the exports amounted to 150,981 tons—an increase upon the preceding six days of 25,995 tons, and of 8836 tons upon the corresponding week of last year. For the year to date, the total imports have been 1,247,249 tons—a decrease on the figures for the same period last year, of 123,423 tons.

Projected New Gas Company for Accrington.—We learn from a local correspondent that arrangements are in progress for the formation of a new Gas Company at Accrington, which will furnish a supply to Accrington, Church, Clayton-le-Moors, and Great Harwood. He says the promoters are advised that they have power to form such a Company, and that they would be able to supply gas at 2s. 1d. per 1000 cubic feet, or 1s. 3½d. less than the price charged by the existing Company. It is proposed that the new works shall be erected in what is known as the Hyndburn Valley; and that the mains shall be laid under the flags of the footpath, so as not to disturb the main roads. The shares are to be £1 each, and confined to residents in the district.

Electric Lighting at Chatham.—The annual general meeting of the Chatham, Rochester, and District Electric Lighting Company on the 21st ult. was marked, writes our local correspondent, by some very extraordinary revelations; it transpiring that two of the Directors had withdrawn from the Board, and that, under a threat from Sir Courtenay Boyle, of the Board of Trade, of the cancellation of the Company's Order, the Chairman (Mr. H. Jasper) had had to undertake the carrying out of the contracts of the Company, whereby the capital shown on the balance-sheet has been doubled. The Chairman was "heckled" concerning the amount of the contract for which £8315 had been allotted in shares, and also as to the legality of the proceedings; but the only answer vouchsafed was that the contract could be inspected at Somerset House, and that the Chairman had only advanced the money when everybody else applied to had refused to do so, even at 25 or 50 per cent. The Company have not paid any dividend. The critical condition of the undertaking was warmly discussed; but nothing definite resulted therefrom. This is the concern which the Chatham Corporation proposed to acquire, for the purpose of competing with the Gas Company in the private and public lighting of the district. But after this, it is not likely that the proposal will be very favourably regarded by the general public.

The Trouble with the Stokers at the Keighley Gas-Works.—In accordance with their promise to the men employed at the Keighley Gas-Works (as recorded last week), the local Trades and Labour Council forwarded a letter to the Gas Committee asking for a thorough inquiry into the whole management of the gas-works by a Committee composed of members of the Gas Committee and three members of the Trades Council. In this way, they thought "the possibility of another strike would be averted, and the whole business would probably be satisfactorily settled." To this letter, the Chairman of the Gas Committee (Mr. R. L. Hallersley) briefly replied that the Committee would receive a deputation of their own workmen whenever they had a grievance; and notice had already been posted in the works to this effect.

The Position of Public Lamp-Posts.—At the Westminster County Court, on the 22nd ult., his Honour Judge Bayley gave a decision affecting London Vestries. The St. Giles's Board of Works were the plaintiffs; and they sought to recover £2 0s. 3d. for damage done to a lamp-post in New Oxford Street by the defendants, the London Road Car Company. The plaintiffs' case was that the defendants' omnibus was going along the street at a rapid pace, and caught the lamp-post, damaging it to the extent of the amount above stated. His Honour: "This lamp was too near the kerb. You must not place the lamp in such a position as to interfere with the free passage of the roadway; if you get it broken in this way, you must put up with the consequences." Judgment was given for the defendants, with costs; his Honour not calling upon Mr. Chilcott, who appeared for the Company. Counsel for the plaintiffs asked leave to appeal; and said that, if his Honour was right, his clients must take down all the lamp-posts. His Honour: "So they ought to do." Counsel asked if his Honour would give him leave to appeal. His Honour said he would not.

Richmond (Surrey) Water Supply.—At an early hour last Tuesday morning, Mr. Martin Peirce, the Clerk of Works at the Terrace Gardens Well, Richmond, succeeded in establishing connection between that well and the one in Water Lane. As our readers may remember, the Terrace Gardens well has been sunk to a depth of 320 feet; and the object (which has now been accomplished) was to drive an adit at this depth to join the deep well in Water Lane. This, it was hoped, might serve two purposes. In the first place, as adits had to be driven in the hope of finding fissures in the chalk that would yield a good supply of water, there seemed to be no reason why one should not be as successful if driven towards the old well as if taken in any other direction. To a considerable extent, this object has been attained. The water will now run by gravitation from one well to the other, and one set of pumps will suffice for both. All the pumping will ultimately be done at Water Lane; but for the present it will be necessary to raise the water from both wells at Terrace Gardens. The Resident Engineer (Mr. W. G. Peirce) was at once informed of his son's success.

Extensions at the Inverness Gas-Works.—A large party of the Inverness citizens assembled at the gas-works last Thursday afternoon, to witness the turning on of the new supply of gas from the large holder which has been erected to meet the growing demands of the consumers. It is on the telescopic principle; the inner lift being 98 feet, and the outer lift 100 feet in diameter. It has a capacity of 185,000 cubic feet; being double the productive power of the works, and leaving a good margin to spare. The cast-iron tank is 102 feet in diameter, and will contain no less that 1,302,000 gallons, or 5800 tons, of water. The whole metal structure is finely designed and executed. It cost £8000, including excavations, foundations, counterforts, retaining wall, &c.; and the builders were Messrs. Newton, Chambers, and Co., Limited. The contract price for the tank and holder only was £6180. The whole extension, which practically amounts to a remodelling of the gas-works, has been executed under the supervision of Mr. J. Thomson, Gas Manager to the Improvement Commissioners, assisted by Mr. R. Thomson, his son. In addition to the holder, four new purifiers, costing £1500, have been put in, and are in working order. They are each 20 feet long and 15 feet wide; their covers, which weigh about 2 tons each, being lifted by a hydraulic crane. They were contracted for by Messrs. Ashmore, Benson, Pease, and Co. Limited, of Stockton-on-Tees. A sum of £300 has been spent upon a boiler and a new governor. Men are now employed in taking down the superseded holders, and clearing the ground which will be required for the extension of the present lime-house The ceremony of turning on the gas was gracefully performed by Mrs. Ross, wife of the Provost.

The Eccup Reservoir of the Leeds Corporation.—A few days ago, a number of the members of the Leeds City Council paid a visit of inspection to the Eccup reservoir, where the work of repairing the faulty embankment and puddle trench forming the northern boundary is now in progress. The visitors were informed by the City Engineer (Mr. T. Hewson) that the puddle wall has been filled in to the depth of 30 feet at the north end, and 18 feet at the south end; and the difficulty with the water percolating into the space appears to have been overcome at this level. The new trench is altogether 180 feet deep, which, as to one-half, is 30 feet deeper than the original trench; the other half being 105 feet deeper than the old puddle wall. One outcome of the excavation has been to prove that the water has been escaping from the great basin at a point under the shallow puddle wall into the valley below; thus wearing away the end of the deep puddle wall. Unfortunately, however, this was not the only defect, for the deep puddle wall was found not to have been carried down to water-bearing strata; hence that part of the trench has had to be deepened to the extent of 30 feet. For this reason, the reconstruction of another extensive section of the embankment became necessary. The latter additional piece of work was jointly recommended by Mr. G. H. Hill and Mr. Hewson; and the contract was recently let to Mr. Gould for £26,000. The reservoir has been out of use two years, and may be empty for five years longer. The efforts to make secure the embankment and the puddle wall have so far cost more than £40,000; and Mr. Gould's contract for the next section is £26,000. Besides this, all the time the contractor is at work, a large staff of men are also engaged at the place for the Corporation. Some of the members who visited the works went away convinced that, before the reservoir has been made sound, not less than £100,000 will have been expended.

Extensions at the Blaina Gas-Works.—At a special meeting of the Directors of the Brynmawr and Abertillery Gas and Water Company held on the 20th ult., the Manager and Secretary (Mr. T. Acland) submitted certain recommendations as to improvements at the gas-works. They comprised the telescoping of one of the gasholders, the erection of two benches of seven retorts, the extension of the purifier-house by a new iron roof 70 ft. by 35 ft., the building of a new meter and governor house, and the laying of a main (about 1000 yards long) for the separate supply of Blaina. Mr. T. Canning, Assoc. M.Inst.C.E., the Engineer of the Newport (Mon.) Gas Company, was present, and fully endorsed the recommendations. It was decided to have the work put in hand and completed as quickly as possible. On the same occasion, Mr. Acland reported that the increase for the current year on the Blaina station of the Company would be at the rate of more than 10 per cent.

Opening Roads without Authority.—At the South-Western Police Court last Wednesday, the contractors for the main-laying work of the Southwark and Vauxhall Water Company were summoned by the Wandsworth District Board for breaking open the pavement in Queen's Road, Battersea, without the consent in writing of the Local Authority. Mr. W. Young, who supported the summons, said the roadway was broken open in order that a main for the Water Company might be laid. The statute absolutely forbade the laying of mains during the month of February, except in emergency cases, and then three days' notice must be given. The restriction was made with a view to prevent accidents, which often occurred in consequence of the condition of the roads. Mr. Pilbeach, Surveyor to the Battersea Vestry, said that the Company had practically ignored the Act of Parliament. They had only given three notices of twenty openings. Mr. Clydesdale, for the defendants, pointed out that, when notices were given, no assent could be obtained. During 1891 there 3000 openings. Mr. Haden Corser: "Then you have broken the law 3000 times." Mr. Clydesdale said that due notice had been given in 99 out of every 100 openings. Whenever notices were not given, the openings must have been made under emergency. Mr. Haden Corser having been informed that the defendants had already been fined on two previous occasions for similar offences, imposed a penalty of £5, with 2s. costs.

The Electric Lighting Question at Yarmouth.—Some months ago, the Corporation of Yarmouth decided on carrying out a scheme of electric lighting, on which they had been advised by Mr. W. H. Preece; and they applied to the Local Government Board for permission to borrow £15,000 for the purpose. Before taking any steps to comply with the request, the Board asked to be furnished with particulars of the proposed works, and a copy of the Order under which they were to be carried out. This matter came before the Council, at a special meeting recently held, on a report brought up by the Electric Lighting Committee, who had decided to supply the required information, and to recommend the Council to appoint Mr. Preece their Engineer; and the Town Clerk was instructed to inquire what his terms would be in case the works were not proceeded with. Two memorials had been presented against the scheme; one being from the Ratepayers' Association, stating that the memorialists felt the light was bound to prove a failure, and result in heavy expense. Mr. Martins moved the adoption of the report; urging that the supply of the electric light was likely to be a paying business after the first year or two. In reply to a question, the Surveyor stated that applications had been received for about 2000 lamps; 4000 being provided in the estimate. Mr. Peaton moved, as an amendment, that the report be referred back to the Committee, with a view to the preparation of a modified scheme. After some discussion, in the course of which the Mayor (Mr. C. H. Wiltshire) stated that, if 2000 lamps were used, it would bring in £4000, and the working expenses would be £1100, the motion was carried by 25 votes to 13.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 584.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investments.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	14 Oct.	10½	Alliance & Dublin 10 p. c.	10	17—18	−½	5 16 8
100,000	10	,,	7½	Do. 7 p. c	10	12—13	..	5 15 5
300,000	100	3 Jan.	5	Australian (Sydney) 5 % Deb.	100	104—106	..	4 14 2
100,000	20	30 Nov.	8	Bahia, Limited	20	11—12	..	13 6 8
200,000	5	16 Nov.	7½	Bombay, Limited	5	5½—6½	..	6 0 0
40,000	5	,,	7½	Do. New	4	4—4½	..	6 13 4
380,000	Stck.	24 Feb.	11½	Brentford Consolidated	100	215—219	+1	5 5 0
180,000	,,	,,	8½	Do. New	100	168—173	..	4 18 3
220,000	20	15 Mar.	11½	Brighton & Hove Original	20	41—43	..	5 6 11
888,500	Stck.	31 Aug.	5	Bristol	100	103—106	..	4 14 4
320,000	20	29 Sep	11½	British	20	42—44	..	5 2 3
50,000	10	15 Mar.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	,,	8½	Do. 7 p. c.	10	14½—15½	..	5 9 8
328,750	10	—	—	Buenos Ayres (New) Limited	10	6—7	..	—
200,000	100	3 Jan.	6	Do. 6 p. c. Deb.	100	98—100	..	6 0 0
150,000	20	24 Feb.	8	Cagliari, Limited	20	24—26	..	6 3 1
550,000	Stck.	14 Oct.	12½†	Commercial, Old Stock	100	245—250	..	5 0 0
165,000	,,	,,	9½†	Do. New do.	100	187—192	..	4 18 11
163,762	,,	15 Dec.	4½	Do. 4½ p. c. Deb. do.	100	127—132	..	3 8 2
800,000	Stck.	15 Dec.	13	Continental Union, Limited	100	227—232	..	5 12 0
200,000	,,	,,	10	Do. 7 p. c. Pref	100	190—195	..	5 2 7
75,000	Stck.	15 Mar.	10	Crystal Palace District	100	187—192	..	5 4 2
486,090	10	27 Jan.	10	European, Limited	10	21—22	..	4 16 11
354,060	10	,,	10	Do. Partly paid	7½	14½—15½	..	4 17 0
5,596,560	Stck.	10 Feb.	12	Gaslight & Coke, A, Ordinary	100	220—225	−2	5 6 8
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	95—99	..	4 0 10
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	260—265	..	3 15 6
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	115—120	..	4 3 4
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	165—170	..	4 8 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	166—170	..	4 2 4
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	260—265	..	3 15 6
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	154—158	..	3 16 0
1,061,150	,,	15 Dec.	4	Do. 4 p. c. Deb. Stk.	100	123—126	..	3 3 6
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	127—132	..	3 8 2
908,000	,,	,,	6	Do. 6 p. c. do	100	167—172	+2	3 9 9
3,800,000	Stck.	16 Nov.	12	Imperial Continental	100	227—230	..	5 4 0
75,000	5	30 Nov.	6	Malta & Mediterranean, Ltd.	5	4½—5	..	6 0 0
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	107—109	..	4 11 9
541,920	20	16 Nov.	5	Monte Video, Limited	20	13½—14½	..	6 18 0
150,000	5	30 Nov.	10	Oriental, Limited	5	7¼—8¼	..	5 1 2
60,000	5	29 Mar.	7	Ottoman, Limited	5	4—4½*	+½	7 7 4
166,870	10	—	2	Pará Limited	10	2—2½	..	—
				People's Gas of Chicago—				
420,000	100	2 Nov.	6	1st Mtg. Bds.	100	103—107	..	5 12 1
500,000	100	1 Dec.	6	2nd Do.	100	100—105	..	5 14 3
150,000	10	—	10	San Paulo, Limited	10	9—10	..	—
500,000	Stck.	24 Feb.	15½	South Metropolitan, A Stock	100	290—295	..	5 5 0
1,350,000	,,	,,	12	Do. B do.	100	238—243	..	4 18 9
230,000	,,	,,	13	Do. C do.	100	245—250	..	5 4 0
750,000	,,	13 Jn.	5	Do. 5 p. c. Deb. Stk.	100	145—148	..	3 7 7
60,000	Stck.	15 Mar.	11½	Tottenham & Edm'nton, "A"	100	225—230	..	5 0 0
				WATER COMPANIES.				
744,897	Stck.	30 Dec.	10	Chelsea, Ordinary	100	262—266	+1½	3 15 3
1,720,252	Stck.	29 Mar.	8	East London, Ordinary	100	211—215*	+1	3 14 4
544,440	,,	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	141—144	..	3 2 6
700,000	50	15 Dec.	8½	Grand Junction	50	110—113	..	3 15 2
708,000	Stck.	10 Feb.	11	Kent	100	277—282	..	3 18 0
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	237—242	+2	3 18 6
406,200	100	,,	7½	Do. 7½ p. c. max.	100	197—202	+2	3 14 6
285,000	Stck.	29 Mar.	4	Do. 4 p. c. Deb. Stk.	100	129—132*	+½	3 0 7
500,000	100	10 Feb.	12½	New River, New Shares	100	323—328	..	3 14 0
1,000,000	Stck.	27 Jan.	4	Do. 4 p. c. Deb. Stk	100	133—137	..	2 18 5
902,300	Stck.	15 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	162—167	..	3 17 10
126,500	100	,,	6½	Do. D 7½ p. c. do.	100	145—150	..	4 6 8
1,155,066	Stck.	15 Dec.	10	West Middlesex	100	260—265	..	3 15 6

*Ex Div.

† Next dividend will be at this rate.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON."

GWYNNE & CO.,

TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

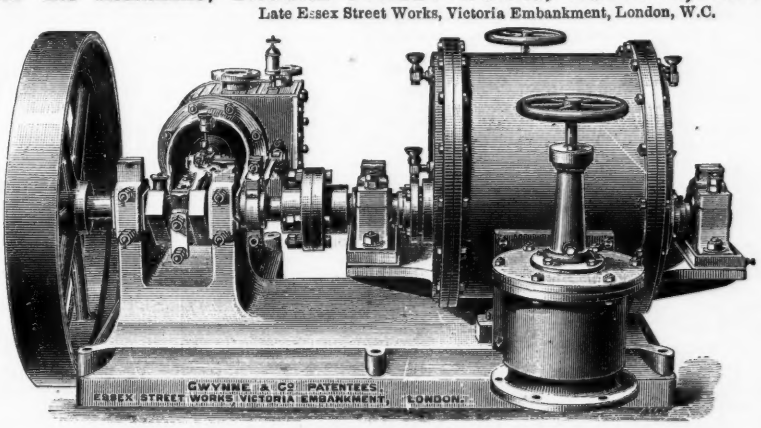
Late Essex Street Works, Victoria Embankment, London, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES HYDRAULIC REGULATORS VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

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Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
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JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent.
Please address all communications to the Company, as above.

ANDREW STEPHENSON, Agent for BRIN'S OXYGEN COMPANY, Limited, Westminster, S.W.
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VOLCANIC Fire Cement (Winkelmann's)
Fire Resistance 4500° Fahr.
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Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, / NEWTON GRANGE, NEAR DALKEITH, } SCOTLAND.

PORTER & CO., Gowts Bridge Works,
LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."

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JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

MANAGER'S Son wants a Situation as MANAGER or WORKING FOREMAN. Had Eight Years' experience on Works making 10 million cubic feet per annum.
Address No. 2216, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a practical Man, a Situation as GAS-FITTER, MAIN and SERVICE LAYER. Would take Management of Small Gas-Works. Has had five years' experience in Electric Lighting. Can do wiring, and all repairs necessary. No objection to going abroad. Good reference.
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THE Ennis Gas Consumers' Company, Limited, require the services of a Man as MANAGER and GAS-FITTER. Must be a good Carbonizer, layer of Mains and Services, and understand the repairs of Meters. Salary, 30s. per week, with House, Fuel, and Light free. Send testimonials with application.
Address the SECRETARY, Gas-Works, Ennis, Co. CLARE.

WANTED, a competent Working Fore-man, for the Harlow and Sawbridgeworth Gas-Works. Must be a good Carbonizer and Fitter, and have held a similar position. State age. Wages, 30s. (House, rent free).
Applications, endorsed "Foreman," with references, to be sent on or before Thursday, April 6, 1893, to
EDMUND F. PARKER,
Secretary.

BROUGHTY FERRY GAS COMMISSION.

MANAGER for Gas-Works wanted.
Salary, £150 per annum, with free House, Gas, Coal, and Taxes. Applicants not to be over 40 years of age. The Person appointed to be prepared to enter on his duties at Whitsunday next.
Applications, stating age and experience, and accompanied with testimonials, to be lodged with the subscriber before the 15th of April next,
D. S. LITTLEJOHN,
Clerk to the Commissioners.
27, Bank Street, Dundee.

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KIRKHAM'S Scrubber, with 8-inch Connections, and four 12 feet square PURIFIERS to be Sold.
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*** See Advertisement p. 613 of this week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

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First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
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FOR SALE—A perfectly new 20,000 cubic feet per hour EXHAUSTER, with Steam-Engine combined, including Hydraulic Gas Governor, Bye-Pass Valves, and Connections.
For further particulars, apply to Mr. T. G. MARSH, 41, Corporation Street, MANCHESTER.

FOR SALE—One Gasholder 36 feet diameter by 15 feet deep.
One GAS-METER 4 feet diameter by 4 feet long, registers to 10 millions, with clock, 6-inch inlet.
Five GAS-RETORTS (Fire-clay), have not been used.
Apply to H. TODD, Jarrow Chemical Works, SOUTH SHIELDS.

FOR SALE, the following second-hand GAS PLANT:—
GASHOLDER, 35 ft. by 14 ft.
GASHOLDER and Cast-Iron TANK, 30 ft. by 17 ft.
Four PURIFIERS, 12 ft. square by 4 ft. 6 in. deep.
Cast-Iron SCRUBBER, 36 ft. high by 10 ft. diameter.
CONDENSERS to pass 500,000 cubic feet per diem.
EXHAUSTER to pass 20,000 cubic feet per hour.
Also various other sizes of above or any Gas Plant. Inquiries invited.
Apply to SAML. WHILE, 60, QUEEN VICTORIA ST., E.C.

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FOR SALE—One 10-inch and one 12-inch STATION GOVERNOR (shortly to be removed to make room for extensions).
Both Governors may be seen at work on application to the undersigned, to whom all inquiries are to be directed.
By order,
C. MEIKLEJOHN,
March 18, 1893. Manager.

RUSHDEN AND HIGHAM FERRERS DISTRICT GAS COMPANY, LIMITED.

IN consequence of the Amalgamation of the Rushden and Higham Ferrers Gas Companies, and the erection of entirely new Works, the Directors of the above Company have the following PLANT FOR SALE:—
One TWO-LIFT GASHOLDER. Outer Lift, 35 ft. by 15 ft.; inner do., 33 ft. 6 in. by 15 ft.
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One TWO-LIFT GASHOLDER, 30 ft. by 20 ft.
SCRUBBER.
PIPE and ANNULAR CONDENSERS.
PURIFIERS.
STATION METERS.
RETORT IRONWORK, HYDRAULIC MAINS.
Various VALVES and CONNECTIONS.
For particulars and permission to view, apply to JNO. T. LEWIS, Engineer, Gas-Works, WELLINGBOROUGH.

LEEDS CORPORATION.
(GAS DEPARTMENT.)

TENDERS are required as below:—
For Turned and Bored and other PIPES, BENDS, TEES, SYPHON WELLS, and other IRREGULAR PIPES.
For BRASS MAIN COCKS.
For 2½, 3, and 4 inch Self-faced BRADFORD or HALIFAX FLAGS.
For CRAVEN or DERBYSHIRE LIME.
For RETORT MOUTHPIECES, STAND-PIPES, DOOR-FRAMES, SPECIAL BENDS, TEES, FLANGE PIPES, &c.
For WROUGHT-IRON TUBES.
Samples may be seen on application at the Stores Department, 21, Dewsbury Road; and Forms of Tender and Specification may be had on application to Mr. Lupton, at the Offices of the Gas Department, Municipal Buildings.
Sample bundles of Tubes to be sent as directed on form of tender.
Endorsed tenders, addressed to the Chairman, will be received not later than Wednesday, the 19th of April next; and no tender will be considered except on the form provided.
The lowest or any tender will not necessarily be accepted.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.

DISSOLUTION of Partnership—Having purchased my late Partner's Interest in the above Business, it will in future be carried on under the style of BALE AND CO.
120 & 121, Newgate Street, London, E.C. ALFRED J. BALE.

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore.
Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Waterside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained, free of charge, at their Offices, 80, CHEAPSIDE, E.C.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; 10, Marsden Street, MANCHESTER; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

LIQUOR and Tar wanted.
BROTHERTON AND CO., Ammonia and Tar Distillers, LEEDS and WAKEFIELD.

PATENTS: Some Popular Delusions.
By W. LLOYD WISE, Esq., J.P., C.C., Fellow of the Chartered Institute of Patent Agents, London. See CALVERT'S MECHANIC'S ALMANAC for 1893. Price 4d.
MANCHESTER: JOHN HEYWOOD, Deansgate; and JOHN CALVERT, 99, Great Jackson Street. LONDON: JOHN HEYWOOD, 2, Amen Corner.

ROCHDALE CORPORATION.

TO BUILDERS AND CONTRACTORS.

THE Gas Committee of the above Cor-poration invite TENDERS for the construction of a BRICK GASHOLDER TANK, 152 feet in diameter, and 35 feet deep. Also for the erection of the BOUNDARY WALLS round the Site of the proposed Tank.
The Plans and Specifications may be seen and Copies of the Quantities obtained, on application to Mr. T. Banbury Ball, the Manager at the Gas-Works.
Tenders, endorsed "Tank" or "Boundary Walls," as the case may be, and stating the amount of the tender for each contract separately, must be sent in to me not later than Noon, on Wednesday, the 12th of April next.
By order,
ZACH. MELLOR,
Town Clerk.
Town Hall, Rochdale,
March 30, 1893.

COUNTY BOROUGH OF WIGAN.
(GAS DEPARTMENT.)

THE Committee invite Tenders for COVERING OVER a disused GASHOLDER TANK, for conversion into a Tar-Well.
Particulars may be obtained from the undersigned.
Tenders, sealed, and endorsed "Tar-Well Covering," to be delivered to the Town Clerk (Arthur Smith, Esq.), Town Hall, Wigan, on or before Monday, April 17, 1893.
The lowest tender not necessarily accepted.
JOS. TIMMINS,
Engineer.
Wigan, March 30, 1893.

COUNTY BOROUGH OF WIGAN.

THE Gas Committee invite Tenders as follows:—
Contract No. 1.—CAST MAINS and CONNECTIONS.
" No. 2.—WROUGHT-IRON TUBES and FITTINGS.
" No. 3.—BRASS TUBES and FITTINGS.
" No. 4.—LEAD PIPES and PIG LEAD.
" No. 5.—WET and DRY GAS-METERS.
" No. 6.—FIRE-CLAY GOODS—*i.e.*, Retorts, &c.
" No. 7.—FIRING and CHARGING SHOVELS.
The Contracts will be for One Year, commencing on the 1st of April next, and ending on the 31st of March, 1894.
Forms of Tender to be obtained from the undersigned.
The Committee do not bind themselves to accept the lowest or any tender.
Tenders, sealed and endorsed with the name of Articles tendered for, to be delivered to Arthur Smith, Esq., Town Clerk, Town Hall, Wigan, on or before Monday, the 17th of April next.
JOS. TIMMINS,
Engineer.
Gas-Works, Wigan,
March 26, 1893.

THE Wokingham Gas and Coke Company invite TENDERS for the supply of about 600 tons of the best screened GAS COAL, to be delivered at the Wokingham Station (Colliery Weight of 21 cwt. to the ton), in quantities as may be required, from the 1st day of May next to the 30th day of April, 1894.

Sealed tenders, endorsed "Tender for Coal," to be delivered to the undersigned not later than Wednesday, April 12, 1893.

The Directors do not bind themselves to accept the lowest or any tender.

WILLIAM IFOULD,
Secretary.

Gas Office, Market Place, Wokingham,
Berks., March 27, 1893.

TENDERS FOR GAS COAL.

THE Corporation of Droitwich invite TENDERS for the supply of about 1200 tons of best screened GAS COAL, at per ton of 21 cwt., to be delivered free at Droitwich (G.W.) Railway Station at such times and in such quantities as may be required.

The contract will be for One Year, commencing on the 1st prox.

Tenders (with analysis of the Coal to be supplied), properly endorsed "Tender for Gas Coal," to be sent to the undersigned on or before the 22nd inst.

The Corporation do not bind themselves to accept the lowest or any tender.

S. JOHN TOMBS,
Town Clerk.

Droitwich, April 1, 1893.

DENTON AND HAUGHTON LOCAL BOARD.
(GAS DEPARTMENT.)

NEW RETORT-BENCH.

THE Board are prepared to receive TENDERS for the erection of a RETORT-BENCH on the Regenerative Principle.

Drawings and Specifications may be seen at the Office of the Manager (Mr. J. Chadwick Smith), Gas-Works, Denton, near Manchester, on and after the 10th inst

Tenders, addressed to the Chairman of the Gas Committee, and marked "Retort-Bench," must be sent in on or before Saturday, the 15th of April inst.

The Board do not bind themselves to accept the lowest or any tender.

By order,
JOHN RICHARDS,
Clerk to the Board.

April 3, 1893.

COUNTY BOROUGH OF SALFORD.
(GAS DEPARTMENT.)

THE Gas Committee are prepared to receive TENDERS for the CAST and WROUGHT IRON WORK required in the construction of a Bench of Eight Beds of Retorts at their Liverpool Street Works.

Full particulars may be obtained on the payment of £5, which will be returned on receipt of a *bonâ fide* tender, on application to the Gas Engineer, Gas Offices, Bloom Street, Salford.

Sealed tenders, endorsed "Tender for Ironwork," addressed to the Chairman of the Gas Committee, to be delivered to me before Five p.m., on Thursday, April 20

By order,
SAML. BROWN,
Town Clerk.

Town Hall, Salford,
March 30, 1893.

WALLASEY GAS-WORKS.

TO BUILDERS AND CONTRACTORS.

THE Wallasey Local Board invite TENDERS (one Contract) for the LEVELLING of LAND, DRAINAGE, Construction of BRANCH RAILWAY, Erection of RETORT and PURIFYING HOUSES, ALTERATION to OFFICES, and other WORK connected with New Gas-Works, at Poulton-cum-Seacombe, Cheshire.

Drawings and Specification may be inspected on application to the Engineer, Mr. H. Ashton Hill, Assoc. M.Inst.C.E., at the Gas and Water Works, Great Float, near Birkenhead.

Copy of Specification and Bill of Quantities, with Form of Tender, can be had on and after the 4th day of April, 1893, on payment of Five Guineas, to be returned on receipt of a *bonâ fide* tender.

Sealed tenders, on the form provided, for the purpose, addressed to the Chairman of the Gas and Water Committee and endorsed "Tender for New Gas-Works," to be delivered at my Office, Church Street, Egremont, Cheshire, not later than Five o'clock p.m. on Monday, the 24th of April, 1893.

The Contractor will be required to enter into a bond with approved sureties, for the due performance of the contract, which contract and bond will be prepared at the expense of the Contractor.

The Board do not bind themselves to accept the lowest or any tender.

By order,
W. DANGER.

Public Offices, Egremont,
Cheshire, April 1, 1893.

NEXT STOCK AND SHARE AUCTION, AT THE MART, TO-MORROW, WEDNESDAY, APRIL 5, AT TWO O'CLOCK, BY

MESSRS. EDWIN FOX and BOUSFIELD, in established Companies:—

SOUTH METROPOLITAN GAS COMPANY—£150 Ordinary "B" Stock. Dividend 12 per cent.

TOTTENHAM AND EDMONTON GASLIGHT and COKE COMPANY—£150 "A" Stock. Dividend 11½ per cent. Also £70 "B" Stock. Dividend 8½ per cent.

BARNET DISTRICT GAS AND WATER COMPANY—£380 "A" Stock and £310 "C" Stock. Dividend 8 per cent. Also 13 £10 "D" Shares. Dividend £3 5 per cent.

GODSTONE DISTRICT GAS COMPANY—60 £5 Shares.

Also Shares in other Companies.

Catalogues at the MART; and of Messrs. EDWIN FOX AND BOUSFIELD, No. 99, Gresham Street, BANK, E.C.

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ALL PARCELS SENT CARRIAGE FREE.

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CONSPIRACY AND PROTECTION OF PROPERTY ACT.—It is required, under a Penalty of FIVE POUNDS, that a printed Copy of the 4th Section of this Act shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by the persons employed thereat. Printed copies of this section, in large type, on broad sheets, price 2/- per dozen, or 10/6 per 100. The Act extends to Scotland and Ireland.

Complete List of Publications on Application.

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TO GAS ENGINEERS & MANAGERS.

CROWTHER BROS.,

Contractors for Retort Setting, Erection of Gas Apparatus, and General Repairs, **have removed from 384, Mile End Road, to**

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Unsurpassed in Efficiency, Economy, Durability, and Easy Working.

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effecting a great saving of time labour, and expense.

For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 22, Alwyne Road, Canonbury, LONDON, N.

Prices are Reduced.

NEWBATTLE CANNEL.

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Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.

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RETORT-LID FASTENER.

CANNOT GET OUT OF ORDER.
DOES NOT DAMAGE LIDS.
SIMPLE & EFFECTIVE.
CHEAP & DURABLE.

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(Wrought out of Holmside and South Moor Collieries.)

PRESENT production over 3200 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16½ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of over

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Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

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BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.,

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

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CANDLE SAFETY LAMPS

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Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
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EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
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THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

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The Analysis made by Messrs. J. and H. T. PATTINSON, Public Analyst for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a working Analysis made of these Coals by the Falmouth Gas Company:—

[COPY.]

FALMOUTH GAS COMPANY,

Offices: *Church Street, Falmouth,*

January 25th, 1893.

Messrs. the

WEARDALE IRON & COAL COMPANY, LTD.,

NEWCASTLE-ON-TYNE.

GENTLEMEN,

From the Cargo of **THORNLEY GAS COAL,** received early this month from you, I have Carbonized at these Works, during a period of thirteen consecutive days, 151$\frac{5}{20}$ tons of the Coal, mixed with 9$\frac{6}{20}$ tons of Cannel Shale (or about 6 per cent.)

The Make of Gas during the above period was 1,624,000 cubic feet.

The whole of the Gas was made from four beds of sixes (24 mouthpieces); each charge being of six hours' duration.

Gas made: 1,624,000 cubic feet.
Coal Carbonized: 151$\frac{5}{20}$ tons.
Cannel Shale: 9$\frac{6}{20}$ tons.
Make per ton of Coal and Cannel Carbonized: 10,082 cubic feet.
Coke per ton (of good quality): 13$\frac{1}{4}$ cwt.

The ILLUMINATING POWER averages from 11 daily tests, **16·5¼ CANDLES,** which was ascertained by burning the Gas at the rate of 5 cubic feet per hour in a certified Letheby Photometer, fitted with a Standard Argand, each Candle consuming 120 grains of Sperm per hour.

Yours faithfully,

J. WM. BUCKLEY,

Engineer and Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.,

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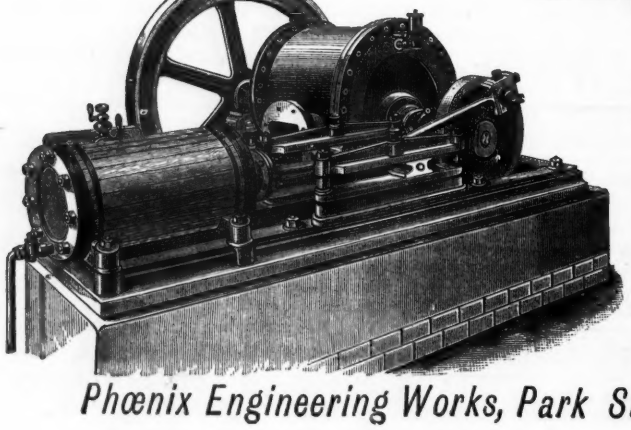
G. WALLER & CO.'S NEW PATENT GAS EXHAUSTER.

MADE, with FOUR or THREE BLADES,

To 250,000 Cubic Feet per Hour, with or without Engine combined.

In use and on order for over 100 Works, equal to 3,850,000 Cubic Feet per Hour.



SPECIAL ADVANTAGES:

This Four-Blade Exhauster will pass fully 15 per cent. more per revolution than any other Four-Blade Exhauster with the same size cylinder, and with from 15 to 30 per cent. less friction or driving power, and without oscillation.

It will pass fully 50 per cent. more per revolution than any Two-Blade Exhauster, with very little increase in driving power for the increased delivery.

No other Exhauster gives such a steady gauge.

OLDEST MAKERS of BEALE'S EXHAUSTERS for 300 WORKS.

MODEL OF PATENT EXHAUSTER SENT FOR INSPECTION.

Patent Compensating Steam Governors. Special Tar-Pumps.

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Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
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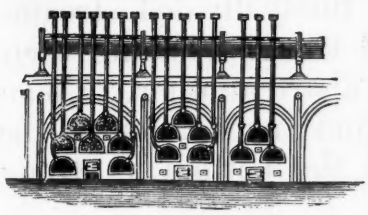

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Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph Chemical, Colliery, and other Companies.
NOTE. — Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

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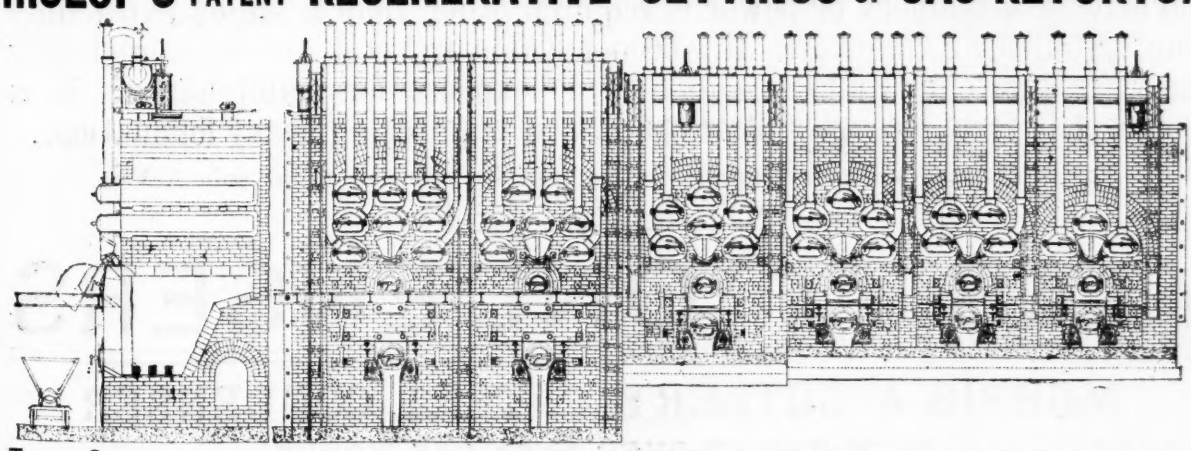
HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.

THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings, or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stewart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge, and from R. F. HISLOP (son of Patentee), Gas-Works, Paisley.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non*
TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS
Under G. R. HISLOP'S PATENTS.

All Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

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THE CHARLES HUNT GAS WASHER

(HUNT'S PATENT).

By this Washer, which performs the functions of both a Washer and Scrubber, any tarry matters are intercepted, and the whole of the Ammonia is removed from the Gas, together with a high percentage of Carbonic Acid and Sulphuretted Hydrogen.

This is effected by causing the Gas to pass in finely-divided streams through a series of light seals, formed by inverted troughs, having their perforated sides submerged in liquid, and placed one above another. Clean Water, being introduced at the top and flowing from tier to tier in the opposite direction to the Gas, leaves the Washer at the bottom as strong Ammoniacal Liquor.

The lower tiers perform the function of a most efficient Tar Extractor, removing from the Gas all traces of tarry matters.

The total back pressure due to this apparatus does not exceed about 7 ins.

The advantages claimed for the Washer are: **It is entirely automatic in action**, depending only upon a constant supply of clean water, proportionate in quantity to the volume of Gas passing. **It has no moving parts**, and thus **no driving machinery or power** is required other than a slight extra duty thrown on the Exhauster. **It is economical in first cost**; there is **practically no wear and tear**; and consequently **no expense for maintenance.** It is **compact in form, occupies little space, and requires no heavy foundations.**

For prices and particulars apply, stating capacity required, to the Sole Makers, Messrs. S. CUTLER & SONS.

GAS CONDENSERS

MORRIS & CUTLER'S PATENT CONDENSER

IS IN USE AT OVER 80 GAS-WORKS.

It is Independent of Atmospheric Temperature,
Prevents the Formation of Naphthaline,
Is Readily Adjusted to Condense varying makes of Gas,
Acts as a Frictional Tar-Separator,
Efficient, Compact, Convenient, Ornamental.

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GASHOLDERS of EVERY SIZE and TYPE.

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Now Ready, Price 6s., Bound in Cloth.

THE CHEMISTRY OF ILLUMINATING GAS.

By NORTON H. HUMPHRYS, Assoc. M.Inst.C.E., F.C.S.

This work contains chapters on: The Relative Cost of Light from Gas, Oil, and Candles; Products of Combustion; The Sulphur Question; The Composition of Illuminating Gas; Water Gas; Various Gas-Making Processes; Oil Gas; Properties of Fluid Hydrocarbons; Tar for Gas-Making; Destructive Distillation; Condensation; and Purification.

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HYDRATED OXIDE OF IRON

FOR GAS PURIFICATION.

Two to three times as rich in Hydrate as Bog Ore.

STRONG ACTION ON SULPHURETTED HYDROGEN.

We have for sale Hydrate of Iron containing 77 per cent. of Ferric Oxide and 17 per cent. of Water. Directions given for mixing for Purifiers.

LESS THAN HALF THE PRICE OF BOG ORE.

APPLY TO—

READ HOLLIDAY & SONS, LTD., HUDDERSFIELD.

SOOTHILL WOOD CANNEL.

Yield of Gas per ton, over 12,000 cubic feet.
Illuminating Power - - - 26 candles.
Coke per ton - - - - - - - 57 per cent.

Of a quality almost equal to that made from the best Coking Coal.

For Analysis and Price, apply to

THE SOOTHILL WOOD COLLIERY CO., LD.,
SOOTHILL WOOD COLLIERY,
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MAKERS OF

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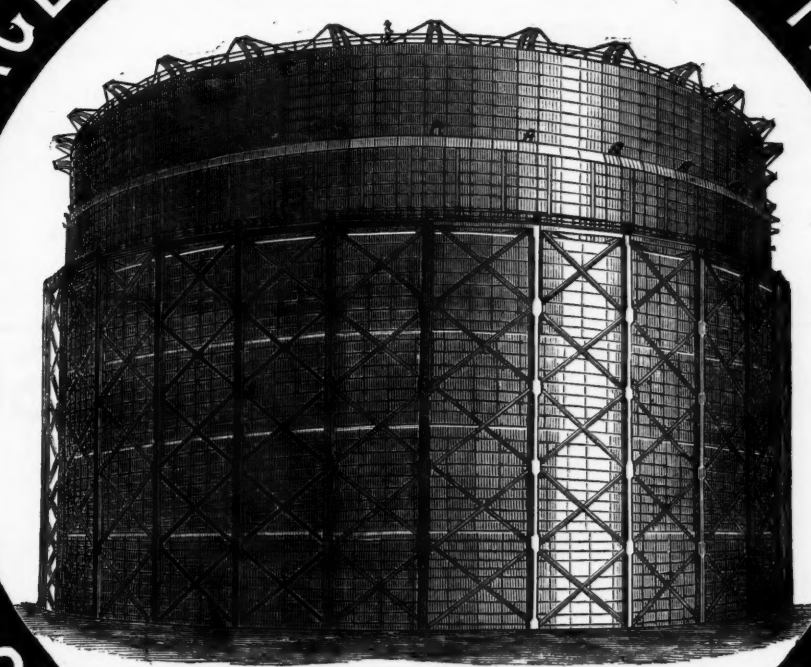
GASHOLDERS OUR SPECIALITY

THE LARGEST GASHOLDER IN THE WORLD.



CAPACITY 12 MILLION CUBIC FT.

ERECTED AT EAST GREENWICH FOR THE South Metropolitan Gas Company
IT HAS SIX LIFTS 30 FT. DEEP EACH AND IS 300 FT. DIAR.

MAKERS OF GAS PLANT OF EVERY DESCRIPTION

ROOFS PURIFIERS &c. ALSO

ADDRESS LONDON 60, QUEEN VICTORIA ST.
TELEGRAPHIC "GAS, LEEDS."

GASHOLDERS OF ANY SIZE

ERECTED & COMPLETED WITHIN 12 MONTHS AND AT THE TIME SPECIFIED

CARLESS, CAPEL, & LEONARD,

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NAPHTHA AND GASOLINE DISTILLERS AND PETROLEUM IMPORTERS

Specially prepare GASOLINE, specific gravity ·650; CARBURINE, specific gravity ·680; or any other Hydrocarbon best adapted for Carburetting Gas.

Prices and Samples may be had upon application.

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,

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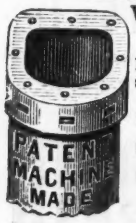

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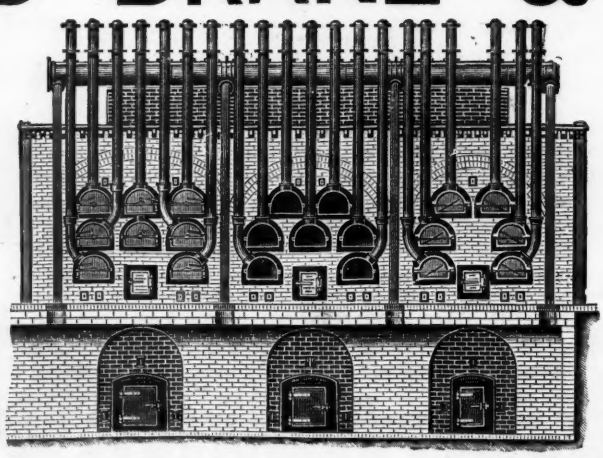

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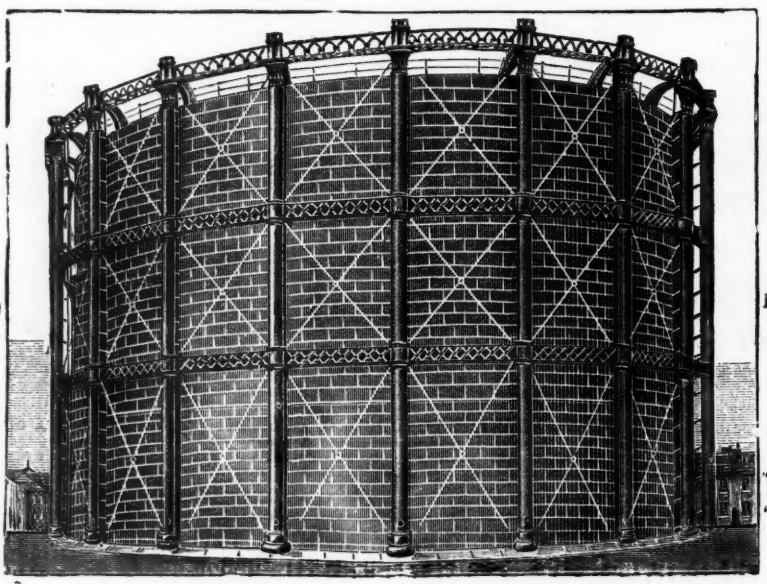

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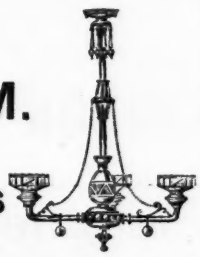

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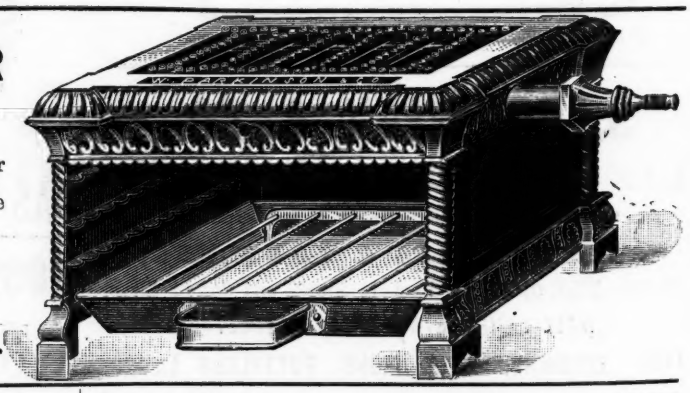

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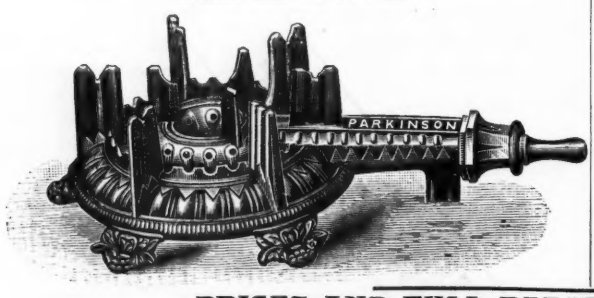

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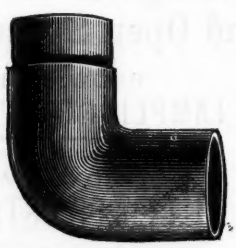

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[See also Advt., p. 580

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